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The Premium Plan in Great Britain.

In connection with the Glasgow Exposition an International Engineering Congress has been held by most of the technical societies of Great Britain. Of these the principal ones were the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Electrical Engineers, the Institution of Mining Engineers, the Institution of Naval Architects and the Iron and Steel Institute, which have unitedly a membership of between 17,000 and 18,000. Many local societies and others of secondary importance also participated, the total number of British societies represented being no less than twenty-seven.

It is highly significant that at this congress no less than three papers were read dealing with the premium plan, all of which gave the experience of their authors with the plan and their endorsement of it. Of these papers, one by Mr. Rowan quotes largely from J. Slater Lewis in commendation of the system, and the total number of endorsements of the plan which appeared at the congress is thus four. The defects of the piece-work and the advantages of the premium plan have nowhere been stated with greater clearness than in these words of Mr. Lewis.

Our readers will remember that the first publication of the plan was in the Transactions of the American Society of Mechanical Engineers.* As is apt to be the case with new things, its progress at first was slow. Not more than three cases are known in which the adoption of the plan was directly or indirectly the outgrowth of its first publication. These cases, however, by the accumulation of experience, paved the way for a larger interest, which dates from the publication in our issue for March 9, 1899, of a tabular exhibit showing the results obtained in one of these cases. Since the publication of this article several employers and others have come forward with contributions or with the offer of material embodying their experience, which has been published and has maintained the interest aroused by the first article.

As the advancement of the plan is thus so largely a result of what we have published about it, it seems eminently proper that we should repeat to our readers in another column these echoes from abroad. We think we will be pardoned for owning to a feeling of satisfaction over the part we have taken in promoting what, it is now obvious, is destined to become an economic factor of large importance in the industrial world.

It is proper to add that from the first quite as much interest has been shown in the plan abroad as at home. Indeed, if our own columns are excepted and if its mention in print be taken as an index, more interest has been shown there than here. Not so many establishments adopting it abroad have been reported to us as at home, though, so far as we can judge, the average size of the works using it in Europe exceeds that of those using it here, and it is not to be expected that the returns would be as complete in point of number from there as here. Whatever an exact numerical comparison might show, it is certain that foreign shop proprietors and managers have shown quite as great a readiness to entertain new ideas in this instance as have Americans, and it is equally certain that the latter are not to have any monopoly of the advantages which go with the adoption of the plan.

This Glasgow Congress is the most important event of the kind which has ever taken place in Great Britain, if not in the world. All British engineers have been greatly interested in it, and its proceedings will be published, and, indeed, are being published, far and wide—some of the English technical papers having issued special numbers devoted to it. With three papers before the congress endorsing the plan and giving their authors' favorable experience with it, attention has been directed to it in a manner which can hardly fail to lead to important results in the way of an increase in its use. Moreover, rightly or wrongly, English manufacturers feel that there is something wrong with their industrial system—in other words, this is there the "psychological moment" when the minds of all are open to the reception of new ideas in shop management. The presentation of these papers at such a gathering and at such a time is most opportune, and it would not be at all surprising if in the near future the progress of the system in Great Britain should far outrun its progress here. We look for that result unless American manufacturers awake to the advantages which the plan offers to its users.

The degree of success which has attended the use of the plan has been far greater than was originally believed by its inventor to be possible. The article of our issue of March 9, 1899, included the following expression of opinion on this subject: "I am in fact fully convinced that the system puts a sharper test on the capacity of the management than it does on that of the workmen, and this fact will determine the limits of its application." This opinion was based on the belief that with many managers the temptation to cut the rates as soon as the workman began to earn substantial premiums would prevail, and that the whole system in such cases would break down. These fears appear now to have been unwarranted. It is gratifying to note how largely those who have written of the plan have recognized the shortcomings of the piece-work system in this respect and the great feature of the new system by which these cuts could be avoided and, indeed, must be avoided if permanent success is to follow.

It can now be fairly claimed that the soundness of the plan has been demonstrated by the most convincing of arguments—actual trial on a considerable scale, under widely varying conditions and in shops of many nationalities; for the plan is known to be in use in the United States, Canada, Great Britain, Germany, Italy and Belgium. It is time for the doubting Thomases to step aside. The procession moves this way, and it is time for all who consider themselves as progressive to consider if it is not time for them to join it.

The present is an unsually favorable time for the adoption of the system. Shops are crowded with work and a

*"The Premium Plan of Paying for Labor" by F. A. Halsey. Trans A. S. M. E., Vol. XII, 1891.

greater output is wanted, while additional good workmen are hard to get. Peace in the industrial world seems to be assured for some time to come, and the opportunity for educating the workmen to see its advantages to them is correspondingly great. Actual trial has never yet, we believe, failed to do this and to make the workmen its enthusiastic advocates. Now is the time to convert them to it on a large scale and to thus lay the foundations for continued harmony.

We have declined to open our columns for discussions of the relative merits of the metric system as compared with the one developed in Great Britain and adopted here, believing that there is already enough literature on that subject. We believe it is proper, however, to print such things as are to be found giving the experience of practical men in the use of the metric system, and especially those things which show to what extent sentiment in favor of the system is developing in Great Britain. The workshops of Greenwood & Batley, at Leeds, England, are famous all over Europe. They do high-grade work in tool building and on government contracts of various kinds for many of the European governments; a very large proportion of their work being on foreign orders. The opinion of a member of such a firm is of course entitled to special consideration, and for that reason the abstract of Arthur Greenwood's paper read at the Glasgow International Engineering Congress and published elsewhere in this issue, will be attentively read by all who recognize the importance of the question.

Employment for the Unemployed.

Engineers are quite naturally brought into close relations with the "problem of the unemployed," and it is not surprising therefore that one of them has written a book devoted to the solution of the problem* and that we now have in the "Journal of the Association of Engineering Societies" a paper by James A. Stewart, entitled "A Plan to Utilize Unemployed Labor." Mr. Stewart read his paper before the Engineers' Club of Cincinnati, and, in brief, his plan is to employ all otherwise unemployed men in constructing homes for themselves, through the agency of a company which is to secure the necessary land, procure the materials and do the banking or perform the equivalent service. He says: "Statistics show that 70 per cent. of the people do not own a home, and I propose to build homes for these people by a co-operation of landowners, material men, merchants and unemployed laborers and mechanics.

"I would organize a savings and a building company, the object of which would be to assure the accumulation of an estate to each of its shareholders by giving him employment at or in his own trade, profession or business when he is out of employment, or giving him an opportunity to increase his business in dull seasons. The result of this labor to be deposited with the company and invested by it in the manner best calculated to secure to each depositor fair dividends on the result of his labor.

"The affairs of the company are to be managed by a board of directors, thoroughly conversant with land values, cost of material and labor, experienced in public works and having the confidence of the people.

"I think there would be little trouble in securing all the land necessary, and about 50 per cent. of the material and labor can be secured. Money would have to be secured to make up the remaining cost of material and labor at the start, but after the confidence of the public was once established, little actual money would be needed. A simple system of exchange of credits is all that is necessary. When an individual's credit amounts to the value of a house, he could be given a deed to the property and his account balanced. The rentals from ten to twenty houses would pay from 4 to 6 per cent. on the investment, and members not wishing a home would be satisfied with that and would leave their principal to be used in the business.

. . . . . .

"It is an indisputable fact that a majority of the people living in the tenement house are the people whose labor is necessary for the construction of homes, and this labor is idle about three months in a year. This enforced idleness keeps them in poverty, when, by co-operation with landowners, material men and merchants who wish to increase their business, they could utilize their labor during that time in the construction of a home.

. . . . . .

"The average time required to obtain a home on the instalment plan will exceed fifteen years, and the amount paid in interest and premium in that time will have doubled the cost of the home. And many an unfortunate one has lost his home and all payments made theron because he could not keep up his interest, premium and dues. The old story—money scarce, dull times, no work for laboring men or mechanics.

"Did you ever stop to think how simple and easy it has been made for the people to invest their idle capital in the form of money, and how hard for them to invest their idle capital in the form of labor, the source of all capital?

"If you have $1,000 or more of idle capital in money, it will not take you more than one hour to get to a savings bank and trust company where you can deposit the money and draw about 4 per cent. interest on it from the day of deposit.

"If you have $1 per week idle capital in money you can deposit it weekly in a building and loan association which meets near your home, and will pay you semi-annually about 6 per cent. interest on your money.

"In building a home, you start all the wheels of industry to moving. Stone must be quarried from the hill, brick made from the original clay, trees felled in the forest, iron and lead taken from the mines; that which is not produced at home must be shipped by rail or water to its destination. The engineer surveys the lot and stakes out the house; the architect prepares plans and specifications; the laborers dig the cellar; teamsters haul the material to the site, and skilled mechanics in their respective branches erect the home. With this labor engaged in productive enterprise, it will necessarily increase the labor engaged in distributing enterprise and improve the business of merchants."

The plan thus outlined is certainly an original one, and it is directed at what is generally recognized by economic writers as being the chief difficulty connected with the problem of the unemployed—*i. e.*, to bring land—the materials of nature—within easy reach of capital and labor, so that they may co-operate for the production of wealth; *i. e.*, desirable things—houses, clothing, shoes, pianos, yachts and food stuffs. Mr. Stewart's paper is not very explicit on this point. He says he thinks there would be "little trouble in securing all the land necessary." But experience shows that wherever development takes place or is expected to take place—wherever men gather or desire to gather for the purpose of building houses or doing anything else of a useful nature—speculative and actual values of land increase proportionately, and, so far as we can see, Mr. Stewart's plan presents no features calculated to either obviate this or to secure for those who do the work and make the improvements any of the proceeds. Nevertheless, a trial of the proposed plan would be interesting, and we should like to see it tried. The object is certainly laudable, for, as has been said of this problem of the unemployed in its relation to modern society: "It is the riddle of the sphinx, which, not to answer, is to be destroyed."

Personal.

A. B. Minton, who has been master mechanic of the Mobile & Ohio railroad shops at Murphysboro, Ill., has been transferred to the shops in Jackson, Tenn.

Chas. H. Shaw, who was formerly the general foreman of the Pennsylvania Iron Works Company, Fiftieth and Lancaster streets, Philadelphia, has become assistant superintendent of the P. M. Sharpes Separator Works, West Chester, Pa.

A convention of the selling agents and representatives of the Union Steam Pump Company, of Battle Creek, Mich., throughout the United States and Canada is being held at Battle Creek, Mich., September 24, 25 and 26.

*"Involuntary Idleness," by Hugo Bilgram.

Commercial Review.

NEW YORK, Monday, Sept. 23.

THE MACHINERY TRADE AND ENTERPRISES CONNECTED WITH IT.

Weather bulletins of the machinery trade still indicate a clear bracing atmosphere. Recent reports from the lines of machine tools and steam engines alike bring news highly favorable. Such effects of President McKinley's death and funeral as have entered business are negligible in any broad view of the situation.

Following is a particularly satisfactory report of the situation from the J. W. Cregar Agency, Philadelphia: "The past two weeks have been the largest in volume of business that we have ever had, and we have just closed an order for twelve planers with one concern and a number of other tools. The prospects in this territory are the brightest that we have ever known."

A machine-tool manufacturing concern of some prominence in Cincinnati has made an advance of 8 or 10 per cent. in the prices of its tools. The move is ascribed to the fact that this company is very busy and has a machine on the market that is regarded as a particularly strong seller. It is not necessarily indicative therefore of an advancing policy among other manufacturers. Another company has been talking of advancing, but on the ground of improvements in its machines. On the other hand, there is a concern which has been inclined to make concessions in price, but which recently closed some valuable business and may be a little more conservative in consequence. From another source of information we learn of a concern in Ohio, but presumably outside of Cincinnati, which has made a raise of 5 per cent. on a general line of tools. In New England, however, a tool-building concern has lately made a reduction of 2½ per cent. The situation is therefore mixed, although it is very likely true that on the average a strengthening tendency exists at least in the West.

One of the most interesting items of domestic news in the machinery industry is the measures that are being taken to found a new mining machinery manufactory in Milwaukee. This is not the same as the new Brown Corliss Engine Company which is establishing a plant there. It is being organized by three men who have just resigned important positions with the Allis-Chalmers Company, and it has therefore the appearance of being a competitor for some of the business of that successful concern in particular. The men referred to are W. D. Gray, H. C. Holtoff and B. T. Leuzarder. The company will probably be incorporated in the next thirty days with a capital of $600,000, and expects to lease temporary headquarters in which to make its patterns while its plant is being erected. It proposes to construct machinery for mining gold, silver, copper, lead and other metals. It will not control patents, but will build the machinery to order.

Improvements of an important character continue at the plant of the General Electric Company in Schenectady, N. Y. The latest enterprise is a new wire and cable shop, plans for which have been approved and contracts for which will soon be let. The building for making cables and covering wires will be 470x100 feet, three stories, and there will be an auxiliary structure 90x250 feet, for leading and compounding cables.

A symptom of the unusually good demand for machinery is shown in the works of a certain well-known company who build steam engines, etc., for a particular purpose of widespread application. They are accustomed at regular intervals to prepare a list of engines in stock, and on a recent occasion the list contained just one engine.

Contracts have recently been let in England for additional equipment for the Metropolitan Electric Lighting plant at Willesden, a suburb of London, to which the Westinghouse Machine Company has in the last few years contributed several engines of several thousand horse-power each. In this case British manufacturers lost the contracts, but Americans did not secure them. The two 6,000 indicated horse-power engines that have just been ordered will be constructed by Sulzer Bros., the well-known Swiss firm. The generators will be built by Kolben & Co., of Prague, Bohemia, the next lowest bidder being, it is understood, the British Westinghouse Electric & Manufacturing Company. The combined amount of the recent orders exceeds $350,000. The award of these contracts to Continental firms is significant, since it indicates the sharp competition that is coming from that quarter as a result of the industrial depression.

Competition breeds retaliatory competition and an instance of it has come to note within the last few days in the department of machine tools. An American manufacturer of a line of specialties has stated that a certain German firm had purchased a number of these and had since placed an imitation of them on the market. The American firm seriously consider fighting the matter out through their German agents, as a question of price. They are very confident that they can build tools so as to beat the Germans in dollars and marks.

A party in Germany has written to a New York machinery house with an attempt to unload a number of American built planers which he has in stock, but which he has been unable to dispose of in Germany. We learn that one of the more prominent German tool builders has a stock of machines on hand estimated at half a million dollars in value.

The strike at the shops of the Watertown Engine Company has ended and the men have returned to work. For the fourteen weeks during which the strike lasted the company entered no new orders, employing a small force of non-union men in finishing up orders previously entered. Orders are now coming in freely and the shops are once more full of work. The company has just installed 1,000 horse-power for the Oxford Paper Company at Rumford Falls, Maine, and is at work on an 800 horse-power plant for the Remington-Martin Company at Norfolk, a 400 horse-power for the Eastern Lumber Company of Tonawanda, 300 horse-power for the Raymondville Paper Company, a 400 horse-power vertical cross-compound high-speed engine for the Mare Island Navy Yard, a 250 horse-power horizontal tandem compound for the Ohio State University, and a considerable number of other smaller high-speed engines.

It is understood that the Russian Government has decided to attempt some amelioration of the iron manufacturing conditions in the region of the Donetz by abolishing the impost on pig iron which now amounts to 1½ copecks per pood (about 50 cents a ton) produced. A request for this action was made at a meeting of manufacturers in Kharkoff. It is said also that the freight rates on ore have been reduced by the Kharkoff Nicolaieff Railroad, a measure which will stimulate the drooping Russian export trade in ore, notably with England.

AMERICAN TRADE WITH SPAIN AND HOW IT MAY BE IMPROVED.

We have received from the house, J. F. Villalta, Barcelona, Spain, importer of American machinery, a contribution in which they go into the particulars of the trade in which they are engaged, severely criticise the methods of some American manufacturers and suggest how obstacles may be overcome. The following is a synopsis covering the greater part of it:

A reciprocity treaty with Spain, in favor of industrial and agricultural machinery especially, is an absolute necessity. We are continually advocating the merits and advantages of American machinery in our country in spite of the lack of an adequate commercial treaty; the high rate of exchange which is greater on dollars than on any other currency; the prohibitive freights (there being no direct line of steamers); the defects of the parcels post system between America and Spain, which impede the quick exchange of samples, catalogs, etc., and lack of acquaintance with and indifference of American exporters to the Spanish market. Further obstacles are bad packing of goods, irregularity of documents and chiefly the policy of giving no credit as distinguished from that of such nations as Germany, which allow six months.

We believe that a suitable commercial treaty would at least double the American export trade with Spain and we have no doubt that it could be increased a hundredfold could the other hindrances spoken of be remedied. Certainly, the trade in agricultural machinery could be increased

tenfold with the co-operation of American manufacturers. The increase should be tirefold in the line of small tools and supplies where Americans stand first as to modernness and quality.

Machinery should be packed as lightly as possible, so as to save gross freights. It should be shipped dismounted where it may easily be set up. Both net and gross weights should be stated.

Since the United States is the most advanced nation in mechanical industry and Spain the farthest behind it would be to the advantage of the latter to make favorable terms for import. Our people are tired of buying goods of inferior quality or at high prices. Low duties would certainly spread the use of American machinery in Spain and would build up industries calling for equipment. While other nations than the United States would profit also, we are confident that American machinery would triumph.

It may be well to consider some of the embarrassments encountered in dealing with America. For one thing, manufacturers ought to keep their engagements. We have been greatly damaged by such people as those who offer to furnish goods in two weeks and do it in two months. On the other hand immediate payments are demanded by them, and some firms selling at 60 or 90 days receive settlements before the importer has seen the goods. Some firms are indisposed to give attention to complaints. Others sell machines as "tested before packed," which examination of the goods shows to be untrue. As Mr. McKinley says, "a maker must find takers" and we may add "when they are found do your best to keep them." One of the worst enemies of business is the excessive self-love of American manufacturers.

Sometimes manufacturers neglect to fulfill their engagements on the ground of strikes, fires, the faults of their clerks or some such buffoonery, while the importer has to pay damages to his customer for whom the machinery has been engaged, or lose trade on which a great deal of pains has been spent.

We can show hundreds of envelopes of letters with insufficient postage, on which we have paid out in the aggregate a good many dollars. Several houses fail to sign their letters and thus render it more difficult to enforce compliance with their engagements. We are sometimes compelled ourselves to make good to our customers failures of the merchandise bought to comply with the catalog statements.

We have to spend a good deal on the introduction of American machinery and sometimes with very inadequate returns. For instance, we have just spent the cost of about ten machines to carry samples into different regions and have succeeded in selling two. We exhibit in the local fairs, as, for instance, the Agricultural Exhibition, of Barcelona, held last May to July, where our exhibit of agricultural machinery received a gold medal, the most important award given to foreign products. Just now we have taken a large place in the Coal and Mining Exposition without material aid from American manufacturers and invited manufacturers to send samples, catalogs, etc., as the mining industry is rapidly growing in Spain.

The Germans are strong upon some points of commercial method in which Americans are weak, and they are slowly but surely securing the Spanish market. The future of the Americans will rest very largely with themselves.

CHICAGO MACHINERY MARKET.

Makers of all kinds and all sizes of engines speak of a most active trade. It is a common report that much business is turned away because deliveries asked for cannot be granted. There is at Chicago quite a market for small engines. The buyer obtains prices, selects the build that is cheapest or preferred, then states that he would like shipment to be made at a certain time, usually two or three weeks. When told that the engine cannot be ready for shipment within two or three months, he terminates negotiations suddenly and begins anew a search, this time for speedier delivery. Taking the other extreme of the market, the representative of a maker of heavy duty engines says there is a large inquiry for engines of from, say, 800 to 1,000 horse-power, which are wanted in four or five months. The business has to be passed by, because shops are loaded with work much farther into the future. The representative of one company says that within the sixteen years of his experience he has not known the demand for boilers and engines to be so brisk as at present. Much business has been closed within the past month; there remain a large number of inquiries, which give promise of continued trade. Much of this activity is in connection with electrical development, not only in street railway enterprises, but in many branches of industry into which electricity is entering as a motive force.

The Colorado Fuel & Iron Company has purchased the equipment for its new wire plant, buying from the Allis-Chalmers Company three 1,500 horse-power, one 500 and one 200 horse-power engines. This engine builder has also sold quite recently two engines of 800 horse-power for an electric railway, to be built between Beloit and Janesville, Wis.; three direct-connected 1,200 horse-power engines to Jones & Laughlins, Ltd., Pittsburgh; a 1,200 horse-power engine to the Hecla Portland Cement Company, Bay City, Mich.; an 800 horse-power engine to the Congress Hotel (Auditorium annex), Chicago; a 400 horse-power engine to the Elgin National Watch Company, Elgin, Ill., and a 2,400 horse-power vertical direct-connected engine to the Dow Chemical Company, Midland, Mich.

Two belted 400 horse-power engines are sold to the Ashland Iron & Steel Company, Ashland, Wis., by A. L. Ide & Sons, who have also sold three 130 horse-power engines to the Hecla Portland Cement Company, Bay City, Mich. The Peerless Portland Cement Company, Union City, Mich., bought a 400 horse-power Hamilton Corliss engine and one of larger power from a Pittsburgh builder.

Filer & Stowell have sold a 1,500 horse-power engine to the Illinois Sugar Refining Company, Pekin, Ill., a duplicate of one sold a year ago to the same buyer.

The Ames Iron Works report trade in the West very brisk. It is only a question of being able to meet deliveries wanted. There is plenty of business in sight.

Boilermakers have been interrupted by a scarcity of tubes. There have been recent shipments of tubes from Chicago to the East, a very unusual trade. With the strike settled betterment of boiler supplies is expected in a few weeks.

The price of boilers is stated by a water-tube boiler man to be so much firmer than it was two months ago that where $10 per horse-power was then considered a high price as much as $13 may now be obtained. Tubes are advancing and have become very difficult to obtain. This condition savors of the year 1899.

Quotations.

NEW YORK, Monday, Sept. 23.

Pennsylvania Foundry Pig Irons, Jersey City delivery:

No. 1 X	$15 15	@ $15 65
No. 2 X	14 65	@ 15 15
No. 2 plain	14 15	@ 14 65
Gray forge	13 50	@ 14 00

Alabama Pig, New York delivery:

No. 1 foundry, or soft	15 00	@ 15 25
No. 2 foundry, or soft	14 25	@ 14 50
No. 3 foundry	13 75	@ 14 00
Foundry forge, or No. 4	13 25	@ 13 50

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.63c. in carload lots; from store, 1.90 @ 1.95c. in small lots.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—1.90 @ 2.00c. from store.

Cold Rolled Steel Shafting—Base sizes—From store, 2½ @ 2¾c.

Copper—Lake Superior ingot, 16⅝ @ 16¾c.; electrolytic, 16⅜ @ 16⅝c.; casting, 16 @ 16¼c.

Pig Tin—About 25⅜c. spot for 5 and 10-ton lots, f. o. b.

Pig Lead—For wholesale lots, 4⅜c., with .02½ @ .05c. extra for carloads.

Spelter—4.10 @ 4.12½c.

Antimony—Cookson's, 10¼ @ 10⅜c.; Hallett's and U. S., 8½c.; cheaper brands, 8¼ @ 8⅜c.

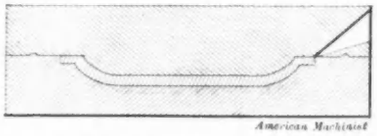
Lard Oil—Prime City, 80c. in jobbing lots.

Making Soft Metal Castings.

A recent United States patent issued to George H. Brabrook, of Taunton, Mass., for a method of producing castings of soft metal will be of interest to many of our readers. The invention relates to a process of making castings from britannia metal or similar alloys composed mainly of tin and lead. It is impracticable to make thin castings of these metals by running into a mold, because they will not sufficiently retain their fluidity.

The present invention is based upon the discovery that stearic acid, if properly applied to the molten metal in the mold, will increase its fluidity, probably by preventing or diminishing the oxidation, and will cause the metal to flow in such a manner as to properly fill all parts of the mold. The method employed consists in exposing the molten metal to the action of stearic acid when running the metal into the mold, the said mold being composed of porous or absorptive material and having the portion forming and adjacent to the inner or pattern surface coated or impregnated with the acid.

The cut illustrates a mold in cross-section, properly prepared. The mold may be made in the usual manner of any suitable absorptive material, such as plaster of paris or baked molding sand, the inner



A MOLD FOR SOFT METAL CASTINGS.

surfaces of the mold being coated or impregnated with the acid. This may be done by warming or slightly heating the parts of the mold, so as to thoroughly dry the same, and then applying stearic acid to the inner surfaces of the mold that are to come in contact with and give form to the metal. The acid material will thus fill and impregnate the material of the mold adjacent to its internal surface, without affecting or changing the form of said surface and will act on the molten metal so that it will readily flow and completely and perfectly fill the mold, thus resulting in the production of a sound and homogeneous casting having a highly-finished surface. The result of the treatment of the metal indicates that some chemical action takes place between the hot metal and the stearic aicd, this action probably involving the liberation of hydrogen which prevents or retards the oxidation of the metal, which oxidation takes place when the metal is not so treated and results in the solidifying or partially solidifying of the metal, so that it will not flow.

It is found in practice that a single coating of stearic acid will enable a mold to be used for several castings, and when it becomes insufficient to cause the metal to flow properly the mold may be supplied with a fresh coating of the stearic acid and again used until the effect thereof is exhausted.

The inventor claims that by the use of this process many articles may be produced which it has heretofore been necessary to make of sheet metal.

"The Adoption of the Metric System in our Workshops."*

With the object of obtaining an expression of opinion of those connected with the mechanical engineering trades assembled in congress at Glasgow, the author ventured to express his views as to whether the time has not now arrived that some steps should be taken towards the adoption in our work shops, in a more or less complete form, of the metrical system of weights and measurements.

In the first place it will be expedient to consider what advantage would accrue to the mechanical engineering trade of this country by the adoption of the metrical system. If the engineers of this country were to devote themselves simply to the manufacture of engines and machinery required in its own workshops and factories, neither selling nor desiring to sell anything outside the Empire, there would be no reason why they should not continue to muddle on with feet, inches, and hundredweights for all time. It would be our own affair to continue, if we thought fit, a system which has been condemned by most nations of the earth. But it may be assumed that the British mechanical engineer has no desire to be content with any such position. He is determined to continue the efforts he has made to push his manufactures in every market in the world. He has to meet competitors in the countries of Europe and elsewhere where the metric system is universal. Germany has followed the lead of the Latin countries, and has abolished her many standards of feet, and Austria has done the same. Russia continued to honor us for years by using our standards, and still does so to some extent, but in Russia before very long the metric system will be as general as it is in Germany. If the British mechanical engineer is to hold his own in these markets, it is imperative that he should offer goods to conform to their usages, in dimensions and weights. The writer would appeal to those of his engineering colleagues who have doubtless found themselves in the same desperate position he has found himself, provided with a drawing of an elaborate machine carefully scaled to an inch or an inch and a half to a foot, and with probably a very imperfect knowledge of the language of the country with which he desires to transact business, and endeavoring to answer the numerous questions of an inquisitive and intellectual foreigner who wants to know the dimensions in millimeters and weight in kilograms of particular parts of the machine. Under such circumstances the wonder is hat orders could be obtained at all. True, experience has taught many engaged in Continental trade to have plans drawn to tenth scale, thus somewhat mitigating the difficulty here alluded to.

The writer could quote numerous cases of orders from France, Germany, Russia, Japan and South America, that might have come to England but for the reason that the purchasers preferred buying machinery which admittedly was not so good or so suited to their requirements, but which conformed to their metric system.

The one serious objection is the cost and trouble of making the change, but this is a difficulty that can be overcome if time is taken to bring about the change. Our legislators so long ago as 1864 made its use permissible, and it is for the leaders in the various trades most concerned to take the next step, and certainly to no trade is it so important as to that of the mechanical engineer; and it is for him to attempt its introduction. It is simply a question of rules, calipers, standards, drills, and reamers, which after all is not very serious. The equivalents can be made from existing standard leading screws in lathes by means of change wheels.

The mention of screws at once calls attention to the most serious part of the suggested change; but that difficulty can be easily met. It would be worse than folly to attempt at present to change the standard pitch and form of screw threads so admirably standardized by Whitworth.

Much as one would wish to see the metric system adopted in its entirety, it would be well at present not to advocate any departure from the Whitworth standard thread. The two systems can and do work admirably together side by side in many shops in France, Germany, Russia, and Sweden.

Much has been said lately about the metric system being made compulsory. Parliament has made it permissible, private initiative should demonstrate that it is practical, and should then call upon Parliament to make it compulsory. It would be a mistake to say two years—a period that has been advocated. Twenty years would be nearer the period.

In conclusion the author added briefly his own experience. For the past twenty-five years the metric caliper-gage has been often quite as familiar in the toolroom at the Albion Works as the inch one, and very little difficulty has been met with from the men. In the engineering works in Russia, in which he is interested, both metric and English standards are used, and little difficulty is experienced in their joint use. At the new workshops just completed at the author's works in Leeds for the manufacture of the De Laval steam

*Abstract of paper by Arthur Greenwood, of Leeds, England, presented at the International Engineering Congress, Glasgow.

turbine, the metric standard has been adopted in combination with the Whitworth standard of thread.

The de Montais Speed-Changing Device.

A new speed-changing device adapted particularly to automobile purposes has been devised by Roger Labbé de Montais and formed the subject of a paper by J. Hirsch read and approved at the meeting of the Société d'Encouragement pour l'Industrie Nationale at their meeting, May 10. It is shown in the accompanying half-tone, Fig. 1, and the line engravings Figs. 2 and 3.

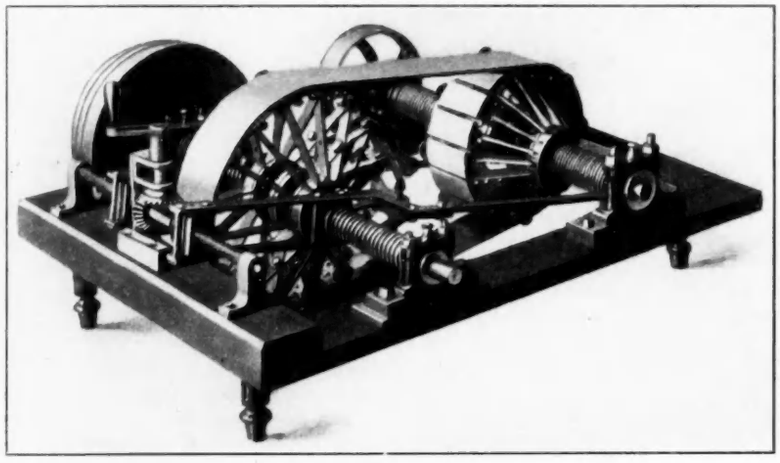


FIG. 1. DE MONTAIS SPEED-CHANGING DEVICE.

The device comprises two pulleys *A* and *B* (Fig. 2) the rims of which are made in sections so that their diameters can be varied. By turning the crank *C* the diameter of *A* is altered while that of *B* changes under pressure of the helical springs surrounding its axle, thus keeping the tension of the belt practically constant.

The rim sections or shoes of these pulleys are supported upon a felloe, or framework formed of two lazy-tongs jointed at their summits and pivoted together at the middle of their branches so as to form a series of equal diamonds which must all elongate or flatten simultaneously. The arrangement is similar in principle to certain gates used on trolley cars and the like. The branches of the diamonds are strips of steel slightly curved and elastic. Some of the shoes constituting the rim are provided with lips to keep the belt from falling off when it is loosened.

The hubs of the pulleys consist of three parts, a middle ring *D* (Fig. 3) keyed to their shafts and two external rings *E E* loose on the shafts. The latter are connected with the felloe by pairs of articulate arms, forming toggle joints. If the movable hub rings be slid along the shaft the whole pulley must expand or contract symmetrically. The middle ring *D* of the hub transmits the rotary motion by four pairs of pivoted rods or strips *F F*.

The special and most interesting feature of the device is as follows: The tendency of the tension of the belt to diminish the size of the extensible pulleys is overcome by helical springs on the shafts, which press the movable parts of the hubs toward the center. These springs are supported at the bearings against collars fixed on the shafts to obviate friction in the rotation. As the sliding rings of the hub approach the center the force of the springs diminishes but at the same time they gain leverage through the changed form of the toggle joints above mentioned. Hence if the force and flexibility of the springs are well calculated there will always be a sufficient tension on the belt and the danger of slipping will be obviated. Another consequence of this arrangement is that in changing the speed it is necessary to alter the diameter of one pulley only and the other will take care of itself.

As shown in Fig. 2 the levers *G G* which are brought nearer together or farther apart by the crank *C* with a pair of bevel gears and a worm screw serve to shift the movable rings of the hub of the pulley *A*. The corresponding parts of the hub of pulley *B* are free to slide and assume a position of equilibrium between the pressure of the springs and tension of the belt. Strictly speaking the springs of pulley *A* are unnecessary, but they are useful, since through the tension of the belt they almost balance those of pulley *B*, so that a small effort only is required to vary the speed relation.

Finally the apparatus can be thrown in or out of gear by loosening the belt which is easily done through the lever mech-

Number of Test.	Motor.		Transmission—Number of Revolutions per Minute.			Brake.	
	Volts.	Amperes.	Driver.	Driven.	Speed Ratio.	Net Load in Kilogrammes.	Metric Horse Power.
1	98	33	305	441	0.691 : 1	3	1.08
2	98	35.5	258.5	311	0.831 : 1	5	1.27
3	98	45.5	329	382	0.861 : 1	7	2.20
4	98	50	290	278	1.04 : 1	10	2.27
5	98	50	350	328	1.07 : 1	10	2.70
6	98	45.5	410	279	1.47 : 1	12	2.75
7	98	45	283.5	189	1.5 : 1	12	1.86
8	98 to 99	35 to 40	344.5	228	1.51 : 1	12	2.24

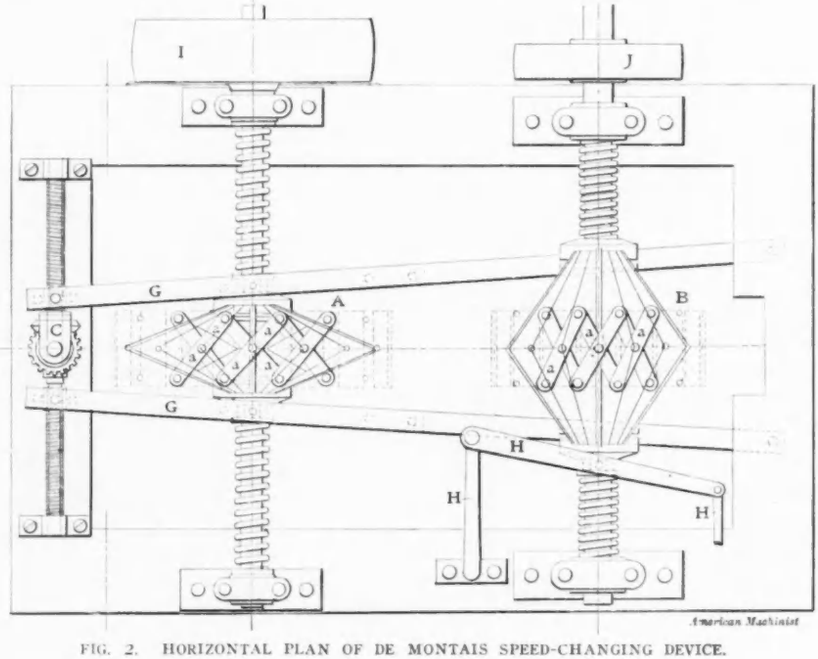


FIG. 2. HORIZONTAL PLAN OF DE MONTAIS SPEED-CHANGING DEVICE.

anism *H H H* in Fig. 2, which acts upon the hub of pulley *B*. Some of the sections of the pulley rims are provided with lips to prevent the belt from falling off when it hangs loosely.

A model of this speed-changing device, which is shown in the illustrations, was subjected to a series of tests. Pulley *A* was used as the driver and *B* as the driven. A wooden pulley *I* was mounted on the shaft of *A* and belted to an electric motor. On pulley *B* was mounted a wooden pulley *J* and to this a Prony brake was applied. The tests which, not to exceed the strength of the apparatus were kept within three horse-power, gave the results shown in the accompanying table.

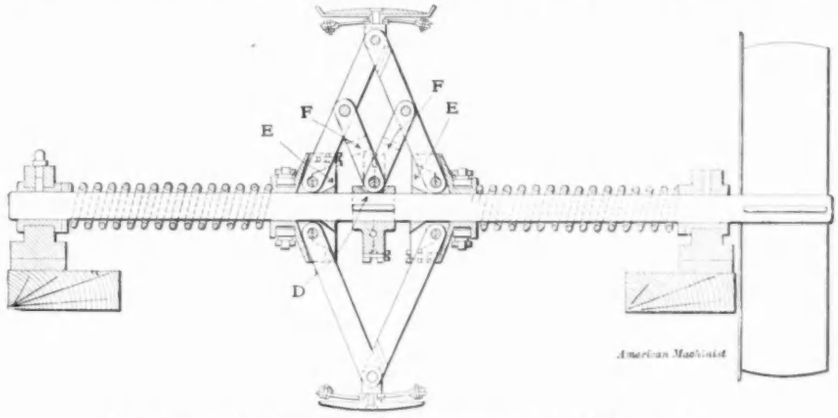


FIG. 3. SECTIONAL VIEW OF ONE OF THE EXPANDING PULLEYS.

Although the apparatus had been installed in some haste and the motor acted rather irregularly the result of the test was highly satisfactory. The transmission was smooth and noiseless. The changes were made without effort and in several of the tests when the speed was caused to pass rapidly from one end of the range to the other the mechanism obeyed with perfect docility. As at present constructed, however, it is only a pioneer attempt and is believed to be capable of indefinite improvement.

An Engraving Machine.

On many lines of work lettering or figuring is to be done that for one reason or another cannot be done by stamping, but must be cut or engraved. Camera makers use such machines, and they are used for a variety of other purposes, including the cutting of seals, etc.

We illustrate herewith a machine made for this work, which is of English origin, but is made here by the George Gorton Machine Company, of Racine, Wis.

The copy or pattern to be followed (which is usually much larger than the letter or design to be cut) is fastened to the table at the rear of the machine, while the work to be operated upon is held upon the platen which is fitted to the top of the knee in front. A tracer or stylus is secured at the end of the long lever, and any movement of this is accompanied by a corresponding movement of the cutter which is held in the spindle. Graduations are provided upon the bars, which enable any desired ratio between the size of the pattern and the size of the work to be readily secured. The plan diagram, Fig. 2, shows the general arrangement of the parts. Lever *L* carries the tracer at the left-hand end, and the cutter spindle is located at *H*. The system of levers is pivoted at *E*, and, as will readily be seen, any movement of the tracer to the right or left will cause a corresponding movement of the spindle, the amount of the latter's movement depending upon the setting of the graduated bar *B* within the block *E*. Any movement of the stylus at right angles to the above-named movement will be accompanied by a corresponding movement of the spindle about the center *G*. The block *H* does not support the spindle but only controls its movements, the spindle being supported in a cradle or arm having two pivots at *a* and *b*, allowing the spindle to be moved in any direction.

At Fig. 3 is a section through the spindle bearings, and this shows also the device for adjusting the spindle vertically.

There are, as will be seen, two screws. The knurled disk is attached to the smaller one of these which passes through the larger one and is fitted with nuts at the bottom, by which the two screws may be made to turn together when desired. The stop-rod *A* may be adjusted to the depth of the cut, or the graduations on the collar or nut may be used to denote the depth from the surface of the work, the graduations having a value of 0.01 inch.

All important working parts of the machine are made of hardened steel, and provision is made for so adjusting it that it will work without the least shake, yet with the utmost freedom and smoothness, as of course is quite necessary in a machine of this character.

Special provision is made for grinding

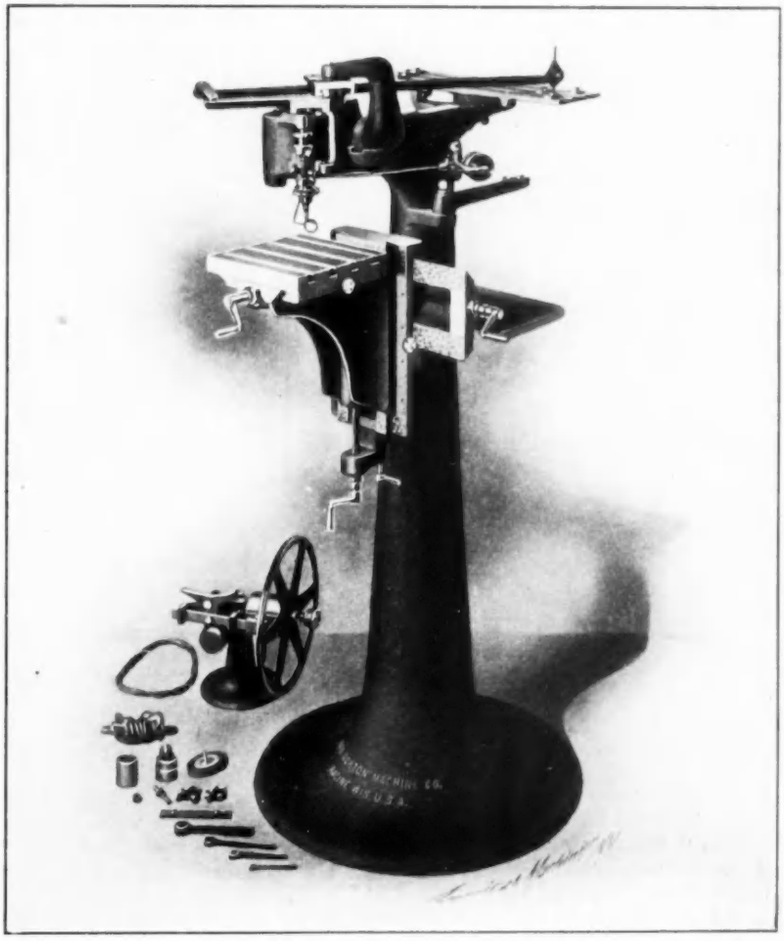
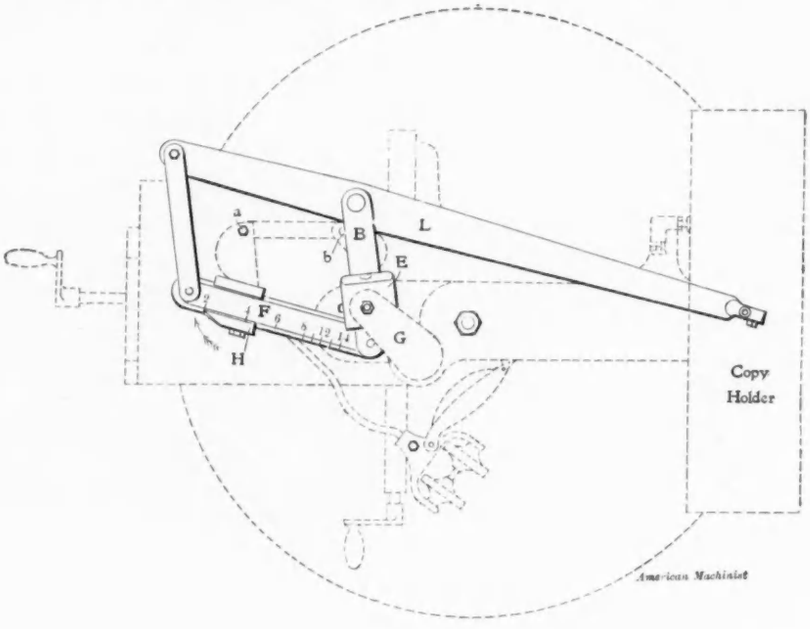


FIG. 1. ENGRAVING MACHINE.

the cutters correctly, and there is also an attachment for holding circular work in the form of disks, cones or cylinders and to rotate the work so as to present successive portions of it to the cutter.

There is also a direct copying attachment, by means of which the copy is placed directly over the work and the copy



Plan

FIG. 2. PLAN DIAGRAM OF LEVERS OF ENGRAVING MACHINE.

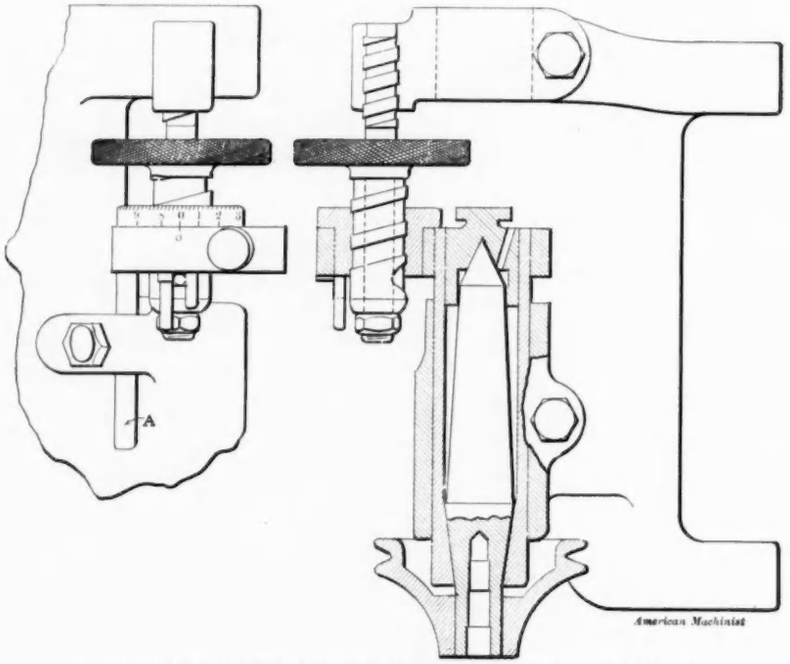


FIG. 3. SECTION THROUGH SPINDLE SHOWING VERTICAL ADJUSTMENT.

reproduced directly and of the same size. We have seen samples of wax seals impressed by dies cut on this machine, which samples were exceedingly beautiful and showed that the machine must have worked with the utmost precision and exactness.

Naval Engineers.

The prominent part played by the engineering end of our naval armament in the "recent unpleasantness" in Cuban waters makes it worth while to consider what we are to do when it becomes necessary to increase our war fleet. For, at the rate at which Germany and other nations are going ahead, with the avowed intention of gaining the naval supremacy of the world, an increase on our part is necessary—whether we like it or approve of it on general principles or not.

Germany is so much in earnest about this fleet business as to find it necessary to order war vessels without waiting for the necessary appropriation, the authorities feeling sure that for once all parties will see the necessity for immediate action.

In one particular, however, Germany has "cut herself a shirt of sixteen yards." She has not now a corps of officers and engineers sufficient for the war vessels already in service—*i. e.*, afloat—to say nothing of those building and of others already built but not yet in commission. Each fall when the "maneuvers" take place, which last two months, she has to call on the North German Lloyd and the Hamburg-American line for officers, who are called "of the reserve," and who bear commission as "officers of the reserve of the imperial navy." (Incidentally, while there is a "German" navy, there is no strictly "German" army; that is, there are various royal and other army corps belonging to the twenty-three various states which make up that republic with hereditary president which is known as the German Empire.) These reserve officers receive full pay from the German Government when in service on "maneuvers," etc., and half their pay from the Lloyd or the Hamburg lines during the same time. They have at the same time a superior social standing to those of their companions in the merchant service who are not in the "Imperial Naval Reserve."

As regards "line" officers, our navy seems at present to be in no great need of any increase in the roll. But when it comes to the engineering corps, we are already short-handed for three reasons: One is that up to very recently there has been a social distinction between the engineers and the "line," which kept many good self-respecting men ashore; another is that the same ability commands better pay ashore than afloat, and a third is that shipboard is no place for a married man —or, to put it "t'other way to," that no woman should marry a sea officer, whether imperial or republican, marine or merchant, "line" or engineer.

Unless something is done, and done soon, the time will come (and soon) when we will need good engineers for shipboard and not be able to get them in the desired and requisite hour. The same thing applies to stokers and greasers.

What I propose is, that our Naval Department arrange for an exchange of services three months in each year between its engineers, stokers and greasers, to the extent of one-fourth or one-fifth at least of the roll, where they can be arranged; giving the "shore" hands, professional and other, who duly enroll themselves as of the naval reserve, full pay and rations, uniform, etc., while on duty afloat and a nominal pay when on shore, so as to legally claim their services on two weeks' notice at any time in case of war, unmarried men to be preferred to those having encumbrances.

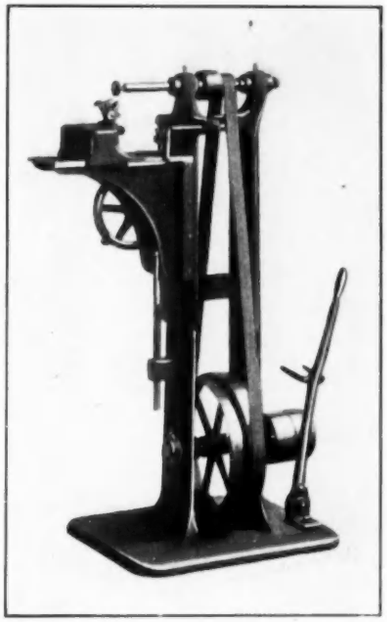
During the time of this sea service for

the landsmen, the professionals could either be employed on shore or allowed to take a furlough during a whole or a part of the "maneuver" time, the ordinary hands being given the shore service, preferably the posts temporarily vacated by the "reservists." The regulars would in most cases be very glad of two or three months of shore service, and particularly if having families; and in the same way and for the same reason that preference should be given to bachelors and widowers for the reserve, the regulars with families should have the first show, as far as they wished it, for the temporary land service.

The result would be an increased efficiency all around, for the naval engineer has too little variety of experience, and the land firemen can learn much afloat about fuel economy. ROBERT GRIMSHAW.

Grinder for Bolt Cutter Chasers.

It is of course important that the chasers that are used in bolt-cutter heads should be ground uniformly both when they are first made and when afterwards they may require sharpening. We illustrate a device for facilitating this operation. It is designed to be used upon the platen of any ordinary cutter grinder. Figs. 1 and 2 give two views of the device for grinding



GRINDER FOR BOLT CUTTER CHASERS.

what is called the mouth or beveled portion of the chaser, and as will be seen the chaser is placed within a groove and secured by a thumb-screw, a gage which is applied to the threads locating it within the groove. The grooved block is set to any desired angle by the graduations shown and when once set any number of chasers are of course ground alike. Fig. 3 shows how the clearance is secured and how by shifting the piece F upon the block B the amount of clearance may be varied to suit circumstances.

The block B being fitted to the knee of the machine, as shown by Fig. 5, it is simply moved under the wheel and out again by hand.

Figs. 3 and 4 show a fixture which is for grinding the front face of the chaser. Its construction and the manner in which it is adjusted will be clear from the engraving. It simply rests upon the platen of the machine and is moved by hand as necessary to grind the surface. These fixtures were devised by the late J. Bennett Wallace and are manufactured by the Modern Tool Company, of Erie, Pa.

The automobile and the requirements of machine tool builders are co-operating to stimulate the invention of speed-varying devices, and many of them are being brought out, both here and abroad. As usual in such cases, some of them are mechanical absurdities, but others are good and are likely to come into general use.

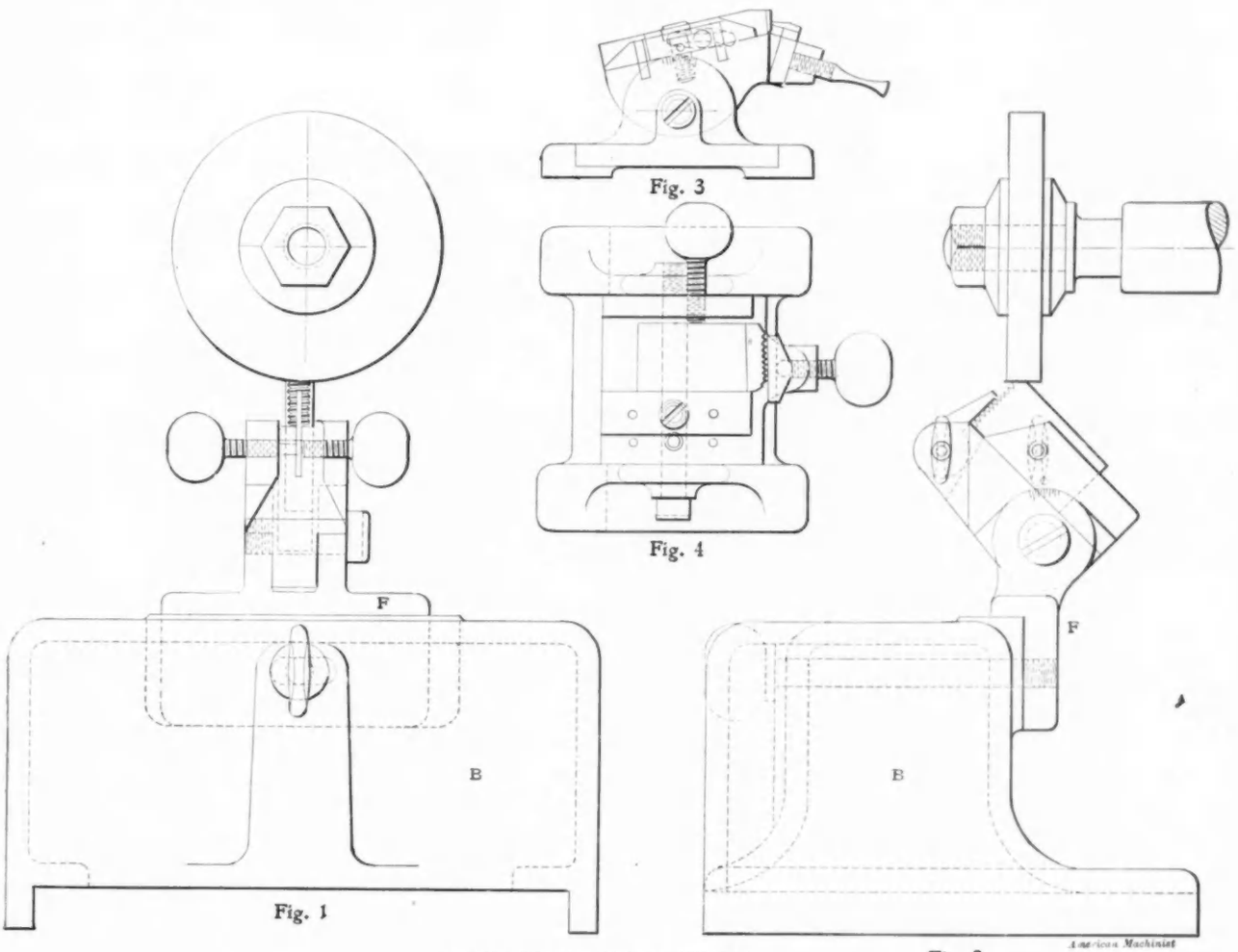
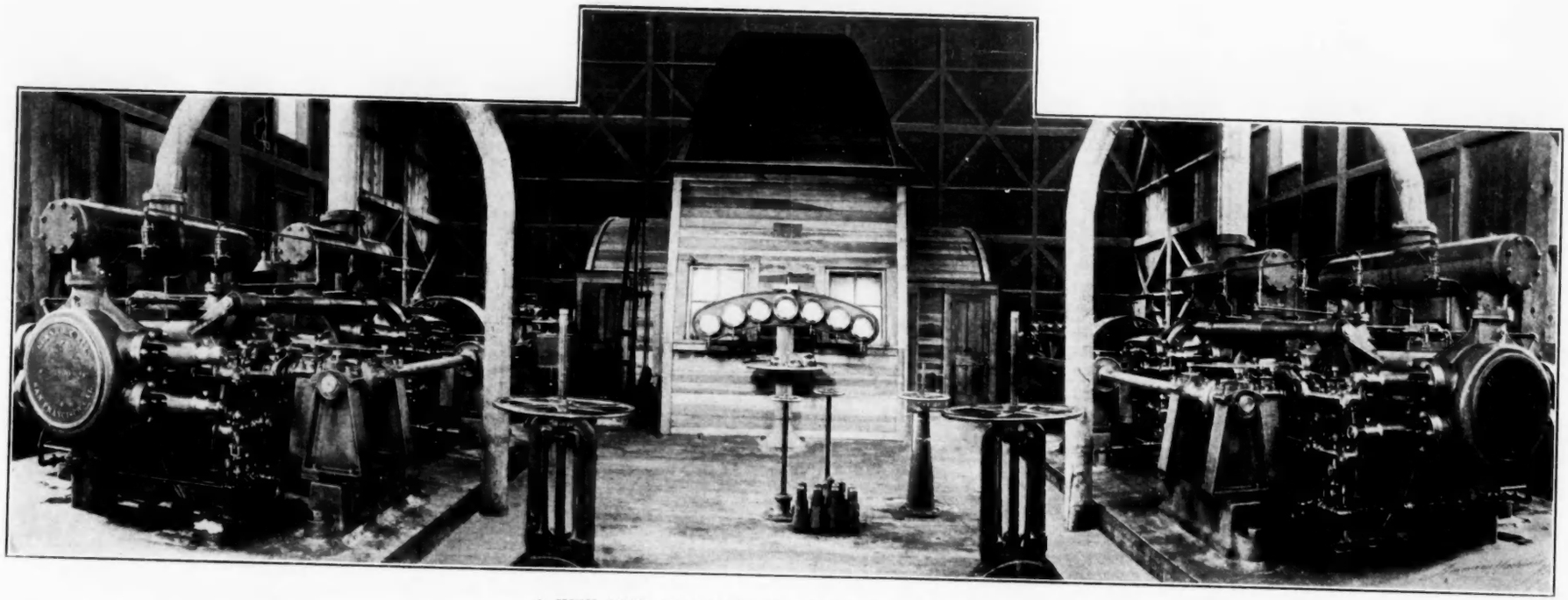


Fig. 1 Fig. 3 Fig. 4 Fig. 2

GRINDER FOR BOLT CUTTER CHASERS.



A HIGH DUTY AIR COMPRESSOR DRIVEN BY PELTON WHEELS.

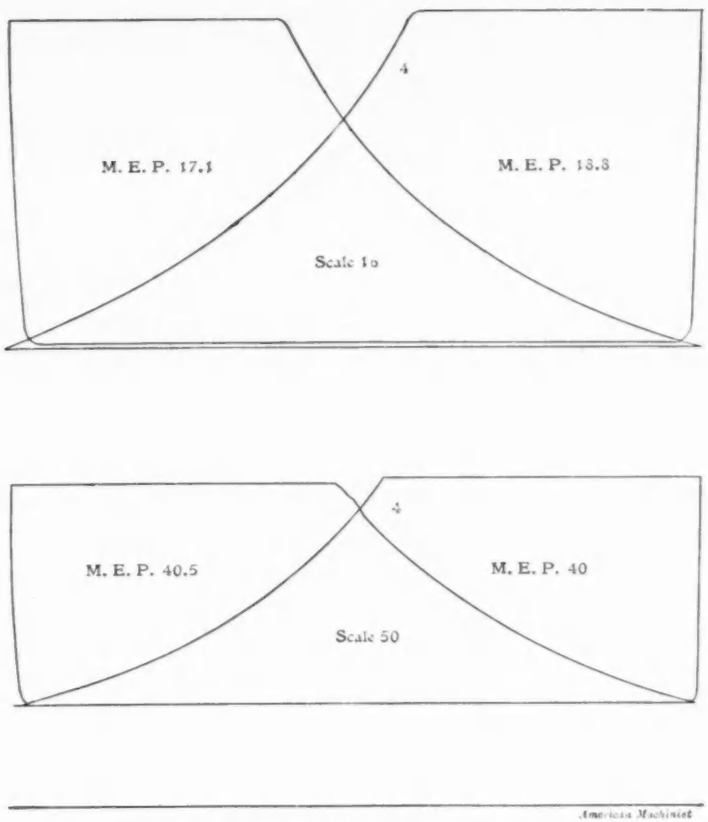
A High Duty Air Compressor Driven by the Largest Pelton Wheel in the World.

In modern mining operations the power problem is usually the most important and often the most perplexing of those to be solved by the engineer. At the Morning Mine, near Mullan, Idaho, compressed air is of course used for operating the rock drills, and until quite recently steam-driven air compressors have been employed. The cost of fuel led to the installation of the air compressor shown in the striking half-tone, Fig. 1. The interest in this case is not confined to the compressor. Three different water powers are made to co-operate in driving this compressor. The Cœur d'Alene River gives a considerable volume of water with a head of 140 feet, and two other streams have heads of 1,140 feet and 1,420 feet respectively. The latter streams impel a central Pelton wheel, 33 feet in diameter, and the other stream is divided to drive a wheel on each side 12 feet in diameter. The combined streams will give a total of 1,100 horse-power at the lowest stage of the water. The river flume is 8,000 feet long, delivering into a 42-inch steel pipe, 490 feet long. The high-pressure lines are of 8-inch and 9-inch standard pipe; one about a mile and a half long and the other about a mile long. The compressed air line consists of 9,500 feet of 12½-inch inserted joint pipe; with a branch of 9-inch pipe, 10,200 feet long, and another 11,700 feet long, also a tunnel pipe of 1,500 feet. These lengths are for the present workings. One hundred drills are to be operated.

The shaft of the compressor is 36 feet long, and with the hub of the wheel it weighs over 46,000 pounds. The wheel, which is the largest tangential wheel in the world, is driven by two jets from the two streams before mentioned. As there is some difference in the heads of the two streams the diameter of the wheel, 33 feet, is a compromise with their requirements. A maximum peripheral speed will be attained of over 8,000 feet per minute. The flow of the water is controlled by suitable slow-acting gate valves, with by-passes to relieve the pipes of excessive pressure. The nozzles also may be deflected clear of the wheel when it is necessary to stop quickly.

The cylinders of the compressors are 33½ and 18 inches respectively, with a common stroke of 42 inches and a maximum speed of 80 turns per minute. The compression in the low-pressure cylinders is to nearly 30 pounds. The air is then thoroughly cooled, and the delivery pressure is 90 pounds, there being also an after-cooler to reduce as much as possible the volume of compressed air to be transmitted. This cooling is all done by the use of pipes in the tail-race of the smaller water wheels.

The valves of the compressors are all operated by positive means. Shafts running parallel with the center lines are geared to the main shaft, and cross shafts for each cylinder carry eccentrics by which the respective inlet and outlet valves of the oscillating or Corliss type, are operated. The most serious problem was of course the opening of the outlet valves, which must occur when the pistons are near the middle of the stroke and moving with a velocity of nearly 800 feet per minute. For each of these valves there is an auxil-



INDICATOR CARDS FROM HIGH DUTY AIR COMPRESSOR.

iary motion actuated by a 6-inch cylinder and piston with 1-inch stroke, which opens the valve instantly, the eccentric closing it at the proper time. The indicator diagrams shown in Fig. 2 give the best evidence in the world of the sharpness and precision of the valve movements.

A complete lubricating system from reservoirs, instead of by separate oilers, is employed. Indicators on the sides of the cylinders permit the valves to be set correctly, independently of the cranks. A governing device is attached which maintains a practically constant pressure. The length of pipe line constitutes a very large air reservoir, so that the fluctuations of pressure are slow. A mercury column is employed, as best suited to actuate relay magnets which control the water supply through suitable electric mechanism. It is interesting to know that there is scarcely any appreciable loss of pressure—not more than 1 pound—in the transmission of the air to the most distant points of the line.

Some data as to the performance of the compressor will be interesting in connection with the indicator cards. The atmospheric pressure where this compressor is installed is but 13.05 pounds. The mean temperature at the time the cards were taken was 55 degrees Fahr.; temperature of the cooling water, 38 degrees; low-pressure discharge, 135 degrees; high-pressure inlet, 46; high pressure discharge, 140 degrees; after-cooler, 62 degrees. The average mean effective pressure from a number of cards taken was: Low pressure, 17.86; high pressure, 41.14; combined, 30.46. The theoretical adiabatic under the conditions would be 36.94 and isothermal 28.5.

Mr. Thomas Cox, the manager and engineer of the mine, designed and installed the water and air conduits and erected the entire plant. The compressor was designed by Mr. E. A. Rix, of the Rix Compressed Air & Drill Company, San Francisco, by whom it was built.

British Experience With the Premium Plan.

We give below abstracts from three papers dealing with the premium plan, which were read at the recent Engineering Congress held in connection with the Glasgow Exposition.

Mr. James Rowan read a paper entitled "A Premium System of Remunerating Labor," which contained the following:

. . . . . .

To the ordinary piece-work system there are the objections which were so well expressed by Mr. Slater Lewis, namely:

"It cannot be pretended, however, that the piece-work system, as usually employed, commends itself as a satisfactory, still less as a final, solution of the problem. We obtain, it is true, an immediate definition and limitation of cost, coupled with a strong and direct inducement for the employee to exert his best endeavors to increase and intensify production. At least this is the theory, but in practice it is a true statement of the result, only within very narrow limits. The defect of the method is, that when once the workman has begun to derive a profit from the transaction, the employer has no direct interest in his further exertions, but only the indirect advantage of a stationary labor-cost coupled with a great intensity of output. The general result of this is, of course, well known and understood. There inevitably comes a time—if the workman continues to improve in skill, or to give evidence of a continuous and successful application of intelligence to his work—when the gains of the workman appear excessive compared with his former earnings as a mere supplier of labor by the hour. The employer would be more than human who did not, at this stage, ask himself the question, 'Have I not made a mistake in fixing prices?'

"When this question is answered affirmatively, a reduction of rates inevitably follows. The suzerain power insists on remodelling the convention, and the result is frequently, not peace, but soreness. Of course where much piece work is in vogue, the trouble does not necessarily arise with as much frequency as might be expected, for a very good reason. As soon as the workman finds himself approaching the point at which his extra earnings tend to rise beyond the limit at which the traditions of the shop teach him the reduction may be expected, his efforts slacken. He makes no endeavor either to improve in skill or to trouble himself about little tricks for the better management and handling of his job. His interest for the future is barred, and the net result amounts to this, that he has adopted a somewhat greater intensity of production, and receives a somewhat greater constant remuneration than when he was on hourly wages.

"That there is a gain, both to man and employer, is obvious; but that it is a slight and limited gain is also obvious. Abstractly considered, the method is remarkable no less for what it wastes than for what it effects.

"From an examination of its defects we are enabled to formulate the conditions which must be fulfilled by a more satisfactory method. We require: (1) a minimum standard of remuneration based on the average attainments of hourly labor; (2) free and full incentive to the workman to improve upon this average, not merely up to a certain arbitrary stage of improvement, but without limit; (3) participation of interests between employer and workman in this improvement, not merely in its early stages, but to the ultimate extent to which the intensification of output and consequent reduction of costs per piece can be carried, either by constantly augmenting manipulative skill, or by a series of small improvements in method. A theoretically perfect system of remuneration should not involve the con-

stant comparison between the piece-work earnings of the exceptionally clever or skillful workman, and his former earnings when neither exceptional skill nor cleverness were asked for nor sought to be rewarded.

"It may be objected that this theoretical perfection is actually realized to the full by the piece-work system, if only we assume that rates shall never be cut. This is, of course, true; but it is not the whole truth. The element of participation by the employer in the direct reduction of labor-cost is entirely wanting, and that such participation is essential and just can be seen readily enough. If it be true that the actual reduction is wholly due to the efforts of skill or of intelligence exerted by the workman, it is equally true that the oportunity for such exertion is provided by the enterprise and perfection of technical and business organization of the firm."

With a view to the adoption of a reliable and satisfactory method of piece work a premium system was decided upon, of which the following is a description.

[The description need not be repeated here as it gives the premium plan as we have repeatedly described it.—Ed.]

The payment of premiums does not take effect until 5-per-cent. premium has been earned, and thereafter only in multiples of 5 per cent. The original time fixed upon as a time allowance has never been reduced, unless there has been a radical change in the method of doing a piece of work. As a rule, the premiums earned by the men have increased since the introduction of this system, sometimes due to the industry, skill or intelligence exerted by the workman, but oftener due to those exercising a controlling power. The value of this premium system is not limited to a saving in cost of labor by the reduction of the time taken to do work. Numerous instances might be cited where the system has been the means of bringing to notice, through concentration of attention on its development, improved methods of manufacture.

. . . . . .

This system is by no means a final solution of the piece-work problem, but it is submitted that this system is a step towards a solution. The value of good and powerful tools is forcibly brought forward, the use of jigs, gages, etc., is found to be necessary, and old machines are placed at their true value. Meetings with managers and foremen for the discussion of questions arising in the course of manufacture are found to be necessary and of great value. Better wages are earned by workmen, and more work and better work is got out of the machines. With this knowledge before us we do not hesitate to say that the introduction of a premium system such as described would have an elevating influence upon any workshop where the hourly rate of pay or the ordinary piece work is in use.

Referring to the quotation given above from Mr. Slater Lewis' paper, the following statements are answered:

1. "A minimum standard of remuneration, based on the average attainments of hourly labor."

This statement is answered by the fact that no matter how long a man takes to do the work, whether from novelty, misfortune, misadventure, hanging over his work or carelessness, he receives his hourly rate of wages.

2. "Free and full incentive to the workman to improve upon this average, not merely up to a certain arbitrary stage of improvement, but without limit."

This statement is answered very fully. If a man is repeating the same job on the same machine and continually reducing the time of production, by all means encourage this man to continue doing so.

3. "Participation of interest between the employer and employee in this improvement, not merely in its early stage but to the ultimate extent to which the intensification of output and consequent reduction of costs per piece can be carried, either by constantly augmenting manipulative skill or by a series of small improvements in method."

Statement No. 3 is almost a repetition of statement No. 2, and it may be added to the reply to No. 2 that if the time allowance has been fairly fixed at the beginning, the more a man earns the cheaper is the work; in other words, the element of participation is introduced.

[Mr. Rowan's paper contained a table of the results given by the system under his management, but, unfortunately, the copy which reaches us is so badly printed as to be largely illegible, and we are hence unable to reproduce it.—Ed.]

Following is an abstract of a paper by William Weir and J. R. Richmond, entitled "Workshop Methods":

So many papers have been written, and so much literature now exists on the equipment and organization of engineering works, that a brief consideration of some less frequently treated factors in promoting efficiency in the shops may be of interest and possibly of value.

No claim to novelty is made on behalf of these schemes, as several of them are of transatlantic origin, but their success when transplanted to this side shows that much can be done to interest the men and the staff generally in their work, and to stimulate the initiation of improvements.

The schemes to be described have now been in operation for some time, so that a fair idea can be given of their working results, and it is the experience of the authors, that when judiciously introduced, they furnish most valuable assistance in the conduct of business.

PREMIUM SYSTEM OF REMUNERATING LABOR.

In an engineering works which for many years has worked with only time wages, workmen who have been employed for a long period in the establishment obtain generally a higher hourly rate than workmen who have only been employed for a comparatively short period, due to their supposed better acquaintance with the work; but in many cases younger and fresher men are better and more productive men than the "old timers,' so that the relative wages do not therefore represent the relative values of the men.

To remedy this state of affairs and to obtain a system whereby every man receives the same standard rate of wages, and in addition an extra remuneration for any increase over a normal basis rate of production, it was decided, after considering all the best known systems of remuneration, to adopt the premium system, for the following reasons:

(1) The system was simple in its conception and easily understood by the men, their extra remuneration being easily calculated by themselves; the differential rate system being open to objection on this point and tending to lead to friction between the men and the administrators of the system.

(2) The system was comparatively simple in its application and did not involve a very large additional staff. In the works in question about 500 men work under premium, and the staff numbers five men and two boys, including the superintendent.

(3) It had not the defect of piece work, that an error in rate fixing is either expensive or discouraging. An error in premium rate fixing only affects the premium, not the wages.

(4) It offered a real inducement to the workman to suggest improvements in his machine or tools. Under the piece-work system, so long as the machine was kept up to a certain standard condition of fitness the man said nothing, as any improvement, he was aware, would probably result in cutting his rate. Under the premium system an improvement suggested by the man benefits him and the employer also, as within reason no rate cutting is found necessary.

(5) The system in its application gives accurate data for time-keeping and cost-keeping purposes. It acts as a double check on the time-keeping, and it associates on one form from the article, the operation and the time cost.

Many different applications are in existence of this system, most of which are excellent, but in considering their application the character of work being done under the system largely influences the correct choice. In our works there is a large amount of repetition work and also a large amount of special work, but in no case are the operations carried out under a premium contract of longer duration than about fifty hours. We therefore adopted the system of paying a premium of 50 per cent. on the time saved.

. . . . . .

After more than three years' experience of the working of the system we have

found the following to be among the many advantages gained by its application:

(1) It has resulted in a largely increased output from our machines for the same labor cost.

(2) An increase in our workmen's average drawings [wages] of from 10 to 40 per cent.

(3) In the practically compulsory maintenance of our machines in the highest state of efficiency.

(4) In a greatly increased interest of the men in their work, machines and equipment, and a fair amount of co-operation in all our schemes for improving our factory.

(5) It has given our foremen a field for choice of men we never had previously, resulting in the employment of only the best class of steady workmen.

(6) It has caused our foremen to be no longer merely taskmasters over the men, but to become more providers of work for them and inspectors of that work.

[Other features of shop management discussed in this paper are: The Friction Club, The Workmen's Suggestion Scheme, The Technical Committee and The Intelligence Department.—Ed.]

Following is an abstract of a paper by William Thompson, entitled "Some Factors Affecting the Economical Manufacture of Marine Engines:"

The most desultory reader of our technical journals cannot fail to be struck with the great and increasing interest which has of late years been taken in the internal economy of our engineering workshops. The object of the following remarks is to draw special attention to certain factors affecting this which have hitherto not received the consideration which their importance warrants. The points particularly referred to are:

(1) A premium system of labor remuneration.

(2) Good, accurate, and powerful tools.

(3) Arrangement of tools and roomy shops.

(4) Standardization.

The Premium System.—The first and greatest of all these influences is the introduction of the premium system, which effects nothing short of a complete revolution in a shop. One of the primary results of this system is the establishment of accurate data upon which comparisons are based and deductions made. The annexed table, columns 1 and 2, gives a few examples of what the premium system has done in the way of economizing time.

[We omit what Mr. Thompson had to say under headings (2), (3) and (4) above.—Ed.]

Description of Work.	Same Machines throughout.			
	(1) Time taken under old Time System.	(2) Time taken on introduction of Premium System.	(3) Time taken in better location with greater facilities.	(4) Record time for the same job.
	Hours	Hours.	Hours.	Hours.
1. Turning conn. rod; 1 off	43½	36	35	29¼
2. Slotting conn. rods; 3 off	31	24½	22¼	20
3. Crank webs (finishing holes; 1 off)	7⅔	5¼	4¾	3½
	Old Machines under		New and more powerful Machines (on Premium System).	
	Old Time System.	Premium System.	First time on new Machine.	Record Time.
	Hours.	Hours.	Hours.	Hours.
4. Turning tunnel shafting; 1 off	42	29¾	23½	21
5. Turning ecc. rods; 1 off	22	11½	9	8¼
6. Turning thrust shaft; 1 off	129	97¼	75	65
7. Finish turning crank shaft; 1 off	42	34	15	9¾
8. Turning quad. blocks; 13 off	195	140	91¼	. .
9. Slotting sole plates; 1 off	70	59¼	41½	35¼
10. Slotting condenser; 1 off	64	56	44	34
11. Slotting H. P. cylinder; 1 off	45¾	33¾	24	21
12. Ripping out holes in crank webs (1 web); 2 holes	29	17	9	7
14. Hole-boring main bearing covers for bolts; 12 holes	45	37	27¼	20
15. Planing six steel slabs for 12 crank webs	142½	102	65½	. .

TABLE SHOWING THE GAINS DUE TO THE PREMIUM PLAN.

Molding a Special Casting.

Figs. 1 and 2 will give a sufficient idea of the casting to be made. It weighs 3,000 pounds. The mold is struck up with sweeps, the various parts forming flanges, etc., being bedded in as the job proceeds. The casting is made in loam, and is made to be cast without the usual "ramming up." It is in two pieces, being divided by splitting plates. Figs. 3 and 4 are a vertical section and plan of the cope with the sweep set and cope bricked up. It is built on a circular bottom plate with a separate plate cast to carry the extending portion of the brickwork. Two building rings *A* and *B*, Fig. 3, are cast in open sand with suitable slot holes cast in as shown. These rings are cast one on top of the other, and are bedded on to the brickwork. When the upper ring is placed on its bed, cast-iron bars, made in the same way as the rings, viz.: one on top of the other, are dropped through the slot holes in the rings, being kept to the outside of the slots by wooden wedges. The space between the bars and the outside of the cope is filled with loam, known as slurry, which

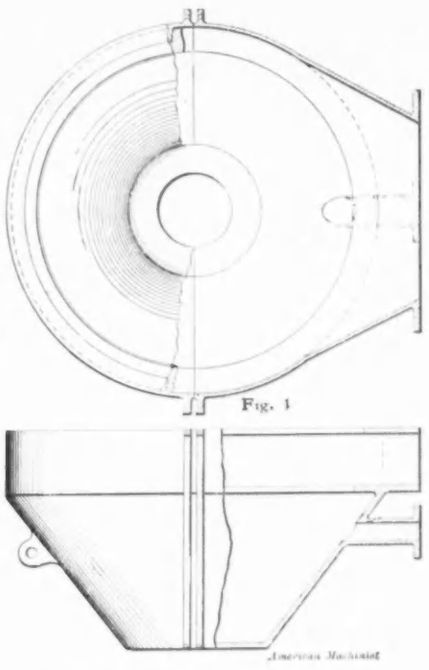


Fig. 1

FIG. 2. THE CASTING TO BE MADE.

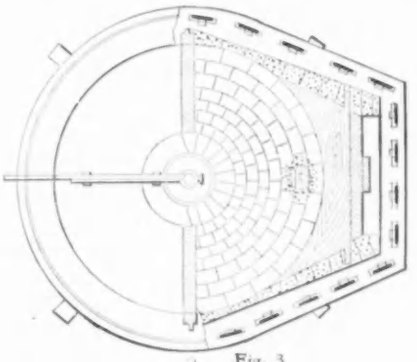


Fig. 3

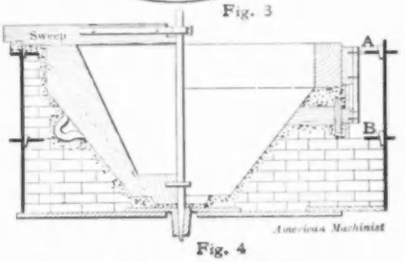


Fig. 4

BUILDING THE COPE.

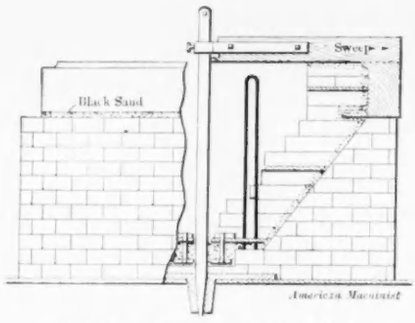


FIG. 5. MAKING THE BODY CORE.

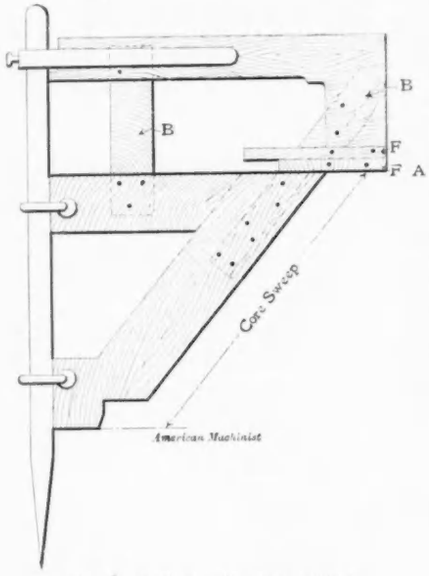


FIG. 6. DETAILS OF THE SWEEP.

is a mixture of black sand and clay wash. The cope being finished, it is let stand over night, when the loose patterns forming flanges, etc., are withdrawn and the mold dressed and "blackened green." It is now ready for the stove.

Fig. 5 is a part sectional view of the body core. As will be seen, the bottom portion is made in a core box formed with a sweep. Fig. 6 shows the sweep complete, attached to the spindle, for striking up the core box. When the core box has been bricked up to the finger *F*, Fig. 6, the battens *B B* are unscrewed, liberating the bottom part forming the core box sweep and leaving the sweep as in Fig. 5, correctly set for the remaining portion of the core, only the one setting of the sweep thus being necessary. The core is bricked as shown in Fig. 5, with various plates bedded to bind the brickwork together until the flange is reached. The bottom and side of the flange are swept and finished off with the fingerpiece *F A*, Fig. 6, and dried a little and filled with black sand, which is leveled off with the finger *F*. As the parts are finished off, the fingers are removed and the building is continued over the sand flange. When complete the core is stoved, the bricks forming the core box are knocked away and the sand in the flange removed. The core is not blackened until thoroughly dry, when it is carded and blackened and tried carefully for size with the calipers, as the thickness of metal is only 5/8 inch, and when working with sweeps errors soon creep in, if the right precautions are not taken to check them. The mold having been thoroughly dried, the cope is set level on the floor and the splitting cores are set in place. Fig. 7 gives views of splitting cores and plates. The cores are provided with a recess to receive the splitting plates, and also with prints for the bolt hole cores. The splitting plates are each in two parts; the top plate marked *C* is not placed in its place until after the body core is set. When setting the body core the spindle is placed in the cope and the core lowered over it, the hole in the bottom plate in the body core having been made a good fit, thus forming an excellent guide to set the bottom of the core by. The branch cores are next set and the loam plates placed too, and the space behind them, which had previously been left open, is bricked up. The top is lowered on and the mold is clamped together with four bolts. This piece is gated around the top thickness with a number of flat gates, so as to avoid any cold shuts. Fig. 8 shows the mold complete and ready for pouring.

GEO. BUCHANAN.

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The Tropenas Converter Steel Process.*

BY A. TROPENAS, PARIS, FRANCE.

In any process for the manufacture of steel, it is necessary to realize certain practical conditions if the process is to be a commercial success. These conditions are: 1. Regularity of the operation. 2. Regularity and absolute control of the quality of the steel.

*From Journal of American Foundrymen's Association. Slightly abridged.

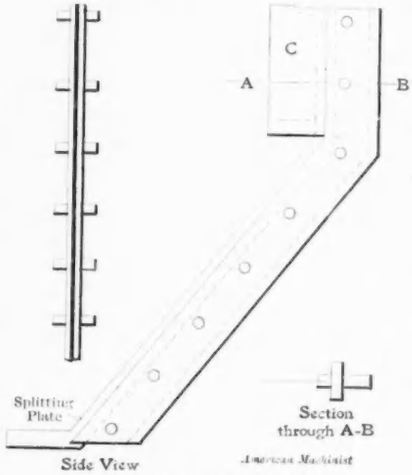


FIG. 7. THE SPLITTING PLATES.

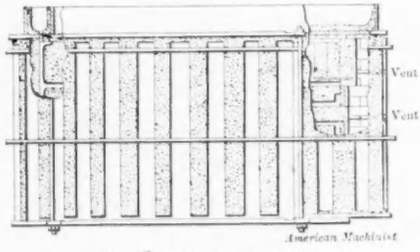


FIG. 8. READY TO POUR.

During recent years many processes for manufacturing steel by means of small converters have been introduced. They have been tried industrially and in most cases abandoned because the extraordinary advantages claimed for them by their inventors have not materialized in practice or have proven to be greatly exaggerated. The failure of nearly all of these processes to realize the absolutely necessary conditions of practical metallurgy has brought into existence a considerable prejudice against the use of small converters and many manufacturers have come to the conclusion that it is impossible to make a good product in such a way.

The process that has been introduced into this country and which forms the object of this paper, possesses the above mentioned features in a high degree, and the results obtained are not based upon mere experiments but on a practical working of over nine years.

The first converter used was of a capacity of about 800 pounds and was erected in 1891-92 in the works of Edgar Allen & Co., Ltd., Sheffield, England. The trials made with this experimental vessel were so satisfactory that after a few weeks the above named firm decided to build a two-ton converter. The results obtained were exactly those anticipated, and since then two other two-ton converters have been erected. This firm has now three two-ton converters with which all its castings are exclusively made. The output of the works at the present time is over 9,000 tons per year. Other plants have since been erected in most of the countries of Europe and three years ago the first vessel was erected in the United States. Some twenty Tropenas plants with over fifty converters are now running in Europe and nine plants with thirteen converters are now running in the United States and Canada.

In all of these works the manufacture of general steel castings for machinery and electrical purposes has been carried on with great success, fulfilling all the physical and chemical requirements. Some ingots have also been made as well as anvils, hammers and similar articles. Steel castings have been made in some recent plants for the United States Government and from the published test tables it can be seen that the material was accepted and of first quality. The ultimate strength is 65,000 to 73,500 pounds per square inch; the elastic limit, 30,000 to 38,000 pounds per square inch; the elongation in 2 inches, 27 to 37 per cent., and the reduction in area 45 to 57 per cent.

Dynamo Magnet steel of extreme purity and permeability can be made with absolute regularity and tests made both in Europe and here show that the product has a permeability not equalled by steel made with any other process.

Large or small castings can be made at will. Small and medium castings are specially made with great facility, sound, free from blow holes, and of a high physical quality. The manufacture of these small and medium castings takes in a field which heretofore it has not been possible to cover with other known steel processes. Though one is specially enabled to make small castings with success, the Tropenas Process is also well adapted for large castings weighing up to ten tons. This can be done by running two two-ton converters alternately and collecting the steel after each operation in a ladle until the required amount is reached. This is made possible owing to the great heat and consequent fluidity of the metal. It has been found in past years that even with obsolete types of cranes and foundry appliances five or six blows could be collected in this way and afterwards poured over the lip of the ladle, leaving no skull. To-day with modern foundry machinery, especially cranes, it is possible to make much heavier castings with a double two-ton plant. Castings up to 5 tons can be made with one two-ton converter in the same manner. The first and second heats will remain hot long enough to accomplish this, and it frequently happens that castings are made with steel a portion of which has remained in the ladle for more than two hours.

The Tropenas plant consists of a special converter in which iron, melted in a cupola beforehand, is converted into steel. This vessel, like all other converters, is a sheet steel shell lined with silica bricks or ganister. The shell is fitted with two hollow trunnions carried on pedestals, so that the apparatus may be tilted according to the requirements of the operation—*i. e.*, charging the molten iron, pouring the steel, etc. The interior of the converter is so designed that the metallic bath has a much greater depth than in any of the other pneumatic processes. The blast enters the converters from the pressure blower through the trunnions, feeding the wind boxes and tuyeres—which direct the air over the metallic bath. The pressure and volume of air are regulated by suitable valves.

Before commencing operations the converter is heated by means of coke or crude oil; afterwards no fuel is needed in the converter, as it is supplied by the metalloids in the iron which are to be eliminated. The pig iron and steel scrap having been melted in a cupola or other furnace is run into the converter, and the position of the converter relative to the level of the metal is then adjusted to the proper conditions for blowing. The blast is started and at a certain period of the operation supplementary blast is introduced at will by means of the auxiliary tuyeres. This completes the combustion of the escaping gases, raising the temperature of the bath by radiation. At the end of the operation a bath of very fluid and soft metal is the result and recarburization is made in the vessel or in the ladle as in other steel processes. By varying the final additions steel of any desired hardness or quality may be produced exactly. The blast pressure required varies between 3 and 4 pounds per square inch, according to the kind of pig iron treated. The blast can be produced by means of a blowing engine or a positive pressure rotary blower.

By what has been said above it is apparent that the characteristic features of the Tropenas process are the following:

First—Low-pressure blast, always above the surface of the metal.

Second—Special disposition of the tuyeres in the horizontal plane, so that the jets of air will enter into the converter above the bath, and will not impart to it any gyratory or tumultuous motion whatever.

Third—Great depths of the metallic bath, so as to avoid churning and stirring during the operation. The result is that the steel contains very little occluded gas and therefore pours quietly into the molds, producing castings free from blow-holes.

Fourth—Arrangement above the "fining tuyeres," and independent of the latter, of auxiliary or "combustion tuyeres," so as to burn the combustible gases which escape from the bath and which in all other pneumatic processes pass unconsumed up the chimney. The combustion of these gases increases the temperature of the bath by radiation very considerably. This makes the subsequent manipulation of the steel in pouring, etc., much easier and more satisfactory. As many as 150 molds have been poured from a heat of about 3,500 pounds, with bull ladles, holding about 125 pounds each. In making large castings it is often necessary to add cold scrap to the steel in the ladle, or to let it stand exposed to the air some minutes to cool before pouring.

By the use of auxiliary tuyeres the carbonic oxide arising from the bath is transformed into carbonic acid gas. By burning these gases in a practical manner, which in all the other processes are discharged without burning into the atmosphere, as stated above, the temperature of the final steel is much increased without any additional cost. The Tropenas process has this advantage, that, being so very hot at first, a great number of the lightest castings can be poured just before the steel commences to get thick, and then the larger castings are taken care of. Using always lip pouring ladles for large and small castings alike, one is able to judge from the surface of the metal its suitability as to temperature for any purpose.

Though the metallic bath is practically quiet during the operation, the reactions caused by the fining blast are quite sufficient to secure a perfect homogeneity of the charge. This is clearly demonstrated when we pour a 2-ton heat into bull ladles for small castings. The steel, as shown by analysis, is found to be absolutely the same from the first to the last ladle.

The handling of the converters is not difficult. A chemist or a foreman can be taught in a few weeks how to work the apparatus properly. As in all other systems, however, a good knowledge of metallurgical chemistry is of the greatest assistance, and it and such assistance by a competent chemist will always prove economical.

The loss of metal during the operation, including cupola and converter, is about 17 per cent. It varies 1 to 2 per cent., according to the kind of material used and the ability of the melters. This is not excessive if it is considered that the loss in cupolas alone is generally from 5 to 7 per cent., and that the iron to be treated usually contains from 5 to 7 per cent. silicon, carbon and manganese to be eliminated. It is scarcely correct to speak of the removal of these elements as a loss, for while being eliminated they serve the useful purpose of raising the temperature of the bath, thus doing away with the necessity for any other additional fuel, as previously stated.

The pig iron used for the production of steel castings analyses as follows:

	Per cent.
Silicon	2.00 to 4.00
Manganese	0.50 to 1.25
Carbon	3.00 to 4.50
Sulphur	up to 0.06
Phosphorus	up to 0.07

The lower the sulphur and phosphorus the better the results. When the steel produced is to be submitted to particularly severe tests, it is better to use pig iron as low in sulphur and phosphorus as possible. One can usually find pig iron here with sulphur 5.015 per cent., phosphorus 0.03 per cent., and the steel made from it will run below 0.05 per cent. in phosphorus. However, when the requirements are only those for the machinery trade, iron up to 0.07 per cent. of phosphorus can be used.

The sands required for making molds are the same as used in other steel foundries and the molds are dried or not according to the kind of castings to be made. Many small and medium castings are made in green sand molds. The steel as it comes from the sand is perfectly soft and malleable. The great majority of the castings delivered to the machinery trade are neither reheated nor annealed. Where castings, however, have great or uneven thicknesses or when they are intended for special purposes it is sometimes necessary to anneal them, the object of this annealing being to simply transform the crystalline structure or to relieve the molecular tension due to shrinkage. Tests made on unannealed pieces have shown that in many cases annealing is entirely unnecessary.

The installation of the steel process proper requires first one or several converters according to the quantity of steel

to be produced. Each converter works usually in connection with a cupola. The cupola is operated in the usual manner, the depth below the tuyeres is greater than in the ordinary cupolas, so as to hold more metal in the well. A fan or blower is used to supply the blast. The air blast for the converter is usually produced by a positive pressure rotary blower. The final additions for the converter are melted in a crucible furnace or a small cupola. Besides the above mentioned apparatus the usual foundry equipment of cranes, oven, flasks, ladles, etc., is necessary. The better a foundry is equipped the cheaper are the castings, and it would be useless to build a foundry and put in converters to turn out large quantities of steel when the equipment to take care of it is not sufficient to handle it quickly and cheaply.

Each operation in the converter lasts from 12 to 20 minutes. The time required for pouring the steel into the ladles and preparing the converter for another blow varies according to the style of castings made. Whenever small castings are manufactured and the whole charge has to be poured into hand ladles, 40 minutes are required for a complete operation. When the pouring is done with large ladles only 30 minutes are required. In the first case 10 blows, equivalent to 20 tons of steel, can be made in 7 hours. In the second case 10 blows, equivalent to 20 tons of steel, can be made in 5 hours. One of the foundries using this process recently stated that they had made 11 blows in an average of 25½ minutes per blow with one 2-ton converter.

The tuyeres used last on an average thirty operations without renewal. With proper care they can be made to last longer. If a large number of operations are carried on at one time, and work is continuous as possible with the same converter, the lining will last longer than with intermittent operations. Usually patching is begun after 20 blows, keeping this up and making about 150 blows before removing the tuyere and setting a new one. The linings are made with silica brick or ganister. The tuyeres are made in blocks of practically the same material as the lining.

The cost of producing steel varies with the price of raw materials, the output and the foundry appliances. One can therefore only give a rough estimate based upon the practical experience of modern foundries. If the price of pig iron is $17, the waste being estimated at 17 per cent., the cost of the steel will be: $17 divided by 83, plus proportional expenses of all other material, plus labor charges. The proportional expenses include all raw materials used in the production of the steel, coke, ferros, bricks, chemicals, etc. The labor includes that at the cupola and the converter, the chemist, etc. For an output of from 300 to 400 tons of steel per month, necessitating three 2-ton converters, labor and raw material taken at present prices, the proportional expenses alone will be about $4.70 per ton and the labor $1.80 per ton. Total cost will be about $17 divided by 83, plus $4.70, plus $1.80—or $26.98 per ton.

. . . . . .

So far as blow-holes are concerned it may be said that if they are found in the castings it is attributable to defective molds or to the manner of casting. When the molds are properly prepared and dried and the metal is poured as it should be, the castings are free from blow-holes.

Fifty thousand tons of steel castings per annum are now produced by the Tropenas process, and the marked favor with which they have been received everywhere shows that they give satisfaction and are successfully meeting all the requirements of the trade. The castings of ordinary soft quality weld as well as the best soft steels. If it is admitted that wrought steel which after welding still has 70 per cent. of its original tensile strength is considered excellent, the two appended tests show that this steel is of very fair quality.

Condition	Elastic Limit	Ultimate Strength	Per cent. Elongation	Per cent. Reduction in Area
Unannealed.....	30,060	56,550	21.00	22.24
Cut and welded.....	37,360	58,947	11.00	30 60
Forged.....	36,330	64,445	33 00	50.70
Annealed.....	32,200	69,000	32.50	44.20
Forged.....	46,850	79,750	24 00	51.10
Cut and welded.....	45,250	63,700	5 00	2.60

A Friction Club.

The following is from a paper read at the recent meeting of the Glasgow International Engineering Congress by William Weir and J. R. Richmond. The club referred to might perhaps have been more correctly called an anti-friction club:

"In every establishment shop problems of various kinds occur, the settlement of which affects different departments. It is not always convenient to get the different foremen together during the day's work to decide on these problems, and any discussions during working hours are apt to be hurried and conclusions come to which maturer consideration may condemn. There are also many suggestions of improvement made casually which may be recognized as good and worthy of adoption. To secure a proper discussion on shop problems and to provide machinery for the systematic carrying out of suggestions and reporting of results, it was decided to inaugurate at our works a club composed not only of foremen but of all the administrative heads of departments, drawing office, costing department, correspondence department, etc. It was named the 'Friction Club' on the principle that its mission was to be the elimination of friction. Meetings are held once a month in the evening. A club letter-box is provided in the shop into which members are requested to send notes on suggestions or subjects for discussion. The decisions of the club are, where necessary, submitted to the directors and receive their sanction before being put in operation."

Table of the Strength of Stunted Gear Teeth.

BY DANIEL ADAMSON.

Noting the table giving the strength of gear teeth by diametral pitch, published in the "American Machinist" No. 25, I send herewith a corresponding table for teeth laid out in accordance with the special proportions used by Joseph Adamson & Co.

We got out this table more particularly for use in connection with our electric traveling cranes, and after getting it out from the data given in your paper (modified to suit our own length of tooth and our materials) we find that it agrees very closely with our previous practice, and on submitting it to an eminent engineer in this neighborhood he informs us that it also agrees with his practice and "should be expected to give satisfactory results."

Hyde, Cheshire, England.

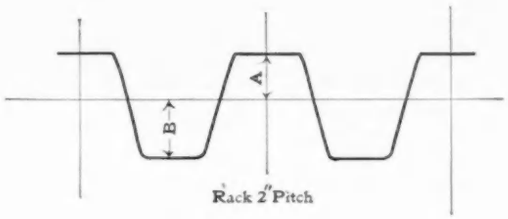
Letters from Practical Men

Modern Ideas of Cutting Speed and the Need of Machine Tools Adapted to Them.

Editor American Machinist:

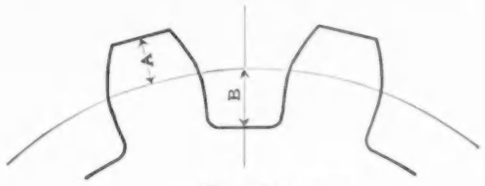
I have been much interested in the article on "Some Points About Drilling and Drill Speeds," in issue No. 34, page 950. It is quite remarkable how even our largest shops, until recently, have failed to realize the importance of running all machines, where roughing work is being done, to the "tool endurance limit," or from lack of power, to the "limit of the belt pulley." At last, however, partly due to more severe competition and the introduction of better steel, and methods of treating the same, we find machine shops all over the country adopting new and advanced methods in machine shop practice; the age being well called that of "intensified production."

The reasons for the sluggish methods, until recently found in our largest shops, cannot be attributed to lack of literature on the subject, as we all probably can remember reading splendid articles on this very subject over ten years ago. There is one point, however, that I wish to bring out, namely, that the builders of machine tools, with a few exceptions, do not seem to have awakened to the fact that we have entered a new era in shop practice, and that a large field is now open for the man who will start a new line of machines designed to meet the requirements of our new tools, heavy enough to be perfectly rigid under the heaviest duty; powerful enough to work all the tools they can handle, under the most severe conditions, and provided with some method of speed



Rack 2″ Pitch

A—Height of tooth above pitch line—.25 of pitch
B—Depth of space below pitch line—.32 of pitch



12 Tooth Pinion
2″ Pitch.

B—A—Clearance—.07 of pitch
A+B—Total height of tooth—.57 of pitch

JOSEPH ADAMSON & Co's PROPORTIONS OF TEETH FOR MACHINE CUT SPUR GEARING

This table is based on the Lewis formula W.—S. P. F. Y. in which W.—load transmitted by the teeth, in pounds S.—the safe working stress of the material in pounds per square inch P.—circular pitch in inches F—the face of the gear in inches Y—the tooth factor for 15 degree involute or Cycloid corrected for J. A. & Cos. proportions.

Speed of Teeth in ft. per Minute	100 or Less	200	300	600	900	1200	1800	2400
Cast Iron Modified to Suit English Iron	5000	4600	4200	4000	3000	2500	2000	1600
Steel Forgings	25000	23000	21000	20000	15000	12500	10000	8000
Gun Metal Copper 10. Tin 1	7500	7000	6300	6000	4500	3700	3000	2400

S For Different Speeds.

No. of Teeth	Y	Circumferential Pitch. ½″	⅝″	¾″	⅞″	1″	1¼″	1½″	1¾″	2″	2¼″	2½″	2¾″	3″	Material
		200	270	300	350	400	500	600	700	800	900	1000	1100	1200	Cast Iron
12	.080	1000	1250	1500	1750	2000	2500	3000	3500	4000	4500	5000	5500	6000	Steel
		300	375	450	525	600	750	900	1050	1200	1350	1500	1650	1800	Gun Metal
		225	281	337	393	450	562	675	787	900	1012	1125	1237	1350	Cast Iron
15	090	1125	1105	1675	1965	2250	2810	3375	3935	4500	5060	5625	6185	6750	Steel
		338	422	505	590	675	743	1012	1181	1350	1518	1687	1856	2025	Gun Metal
		250	312	375	437	500	625	750	875	1000	1125	1250	1375	1500	Cast Iron
18	.100	1250	1560	1875	2185	2500	3125	3750	4375	5000	5625	6250	6875	7500	Steel
		375	468	562	656	750	937	1125	1312	1500	1687	1875	2062	2250	Gun Metal
		275	344	412	480	550	687	825	962	1100	1237	1375	1512	1650	Cast Iron
21	.110	1375	1720	2060	2400	2750	3435	4125	4810	5500	6185	6875	7560	8250	Steel
		412	516	618	720	825	1030	1237	1443	1650	1856	2062	2268	2475	Gun Metal
		300	375	450	525	600	750	900	1050	1200	1350	1500	1650	1800	Cast Iron
27	.120	1500	1875	2250	2625	3000	3750	4500	5250	6000	6750	7500	8250	9000	Steel
		450	562	675	787	900	1125	1350	1575	1800	2025	2250	2475	2700	Gun Metal
		325	406	487	568	650	812	975	1137	1300	1462	1625	1762	1950	Cast Iron
40	.130	1625	2030	2435	2840	3250	4060	4875	5685	6500	7310	8125	8810	9750	Steel
		487	609	730	852	975	1218	1462	1705	1950	2293	2437	2643	2925	Gun Metal
		350	437	525	612	700	875	1050	1225	1400	1575	1750	1925	2100	Cast Iron
80	.140	1750	2185	2625	3060	3500	4375	5250	6125	7000	7875	8750	9625	10500	Steel
		525	656	787	918	1050	1312	1575	1837	2100	2362	2625	2887	3150	Gun Metal
		375	468	562	656	750	937	1125	1312	1500	1687	1875	2062	2250	Cast Iron
Rack	.150	1875	2340	2810	3280	3750	4685	5625	6560	7500	8435	9375	10310	11250	Steel
		562	702	843	984	1125	1405	1687	1968	2250	2530	2812	3093	3375	Gun Metal

Table giving safe working loads (W.) on the teeth of Joseph Adamson & Co's standard cut gears one inch wide of Cast Iron running at a speed not exceeding 100 feet per minute.

For higher speeds the loads must be reduced in proportion to the corresponding figures in smaller table.

In estimating the strength of teeth by this table the with must not be taken at more than three pitches although considerations of wear may make it advisable to adopt a tooth wider than this proportion.

For example a tooth 1″ pitch 3½″ wide must be taken as if only 3″ wide.

American Machinist

TABLE OF THE STRENGTH OF STUNTED GEAR TEETH.

variation, so that work of all diameters can be machined at the most efficient speed. How many builders of lathes, for instance, have taken this matter up from the standpoint of the manufacturer who is doing a large amount of roughing work and is willing to use the best tools and the most modern methods? If we investigate the matter we find some lathes are sufficiently heavy, with rapid and efficient feed changing devices, but are ridiculously low in power; others possess great accuracy, but only under the old conditions—taking light cuts and with slow speed. The old motto of "Save the tools" is a thing of

the past in progressive shops, the object now being to put the machines on the scrap heap as soon as possible. It should be the object, however, of the machine tool builder to turn out work that will live as long as possible under the new requirements.

Machine designing is no longer a matter of guesswork. The power required to take a cut of a certain depth, and with a given feed and cutting speed for a given material can easily be determined by experiment. The circumferential speeds are also determined by the range of work, the kind of material to be machined and the cutting steel used. Quick-changing feeds have already been successfully applied to several kinds of machines, but the question of variable speed has received but scant attention. The importance of this point cannot be overestimated. Take the case of a 10-foot boring mill at the Link-Belt Engineering Company's works, which I have in mind; it has a five-step cone, and together with the gears ten table speeds are possible. The revolutions per minute of the table vary from 1 to 32. We found from actual practice that the *average* work on this mill was machined some 20 per cent. below the most efficient point. Assume that 80 per cent. of the time the mill was working on cuts, we see a saving of $320 per year could be made if a variable speed drive be used. (These figures are for day-shift only.)

Man's wages per year	$780
Interest on tool and depreciation (20 per cent. of $5,000)	1,000
Floor space	120
Power	100
	$2,000

$$\$2{,}000 \times .80 \times .20 = \$320.$$

The above case is not theoretical in any sense and shows what big savings may be effected where a large number of tools are in use.

The question of how to obtain this speed variation in a practical and efficient way is not so easily answered. Several mechanical devices are on the market now and have proved satisfactory in many cases; they all, however, depend on some form of friction and do not seem to meet the general requirements of machine tools. The only present hope appears to be in the variable speed motor, for here we have a positive drive and a speed variation in some cases of 4 : 1. I do not want to go into details here, but rather to point out features which I think should be given more thought and study by the designer of machine tools. I do not, however, refer to special tools; these often meet every requirement. It is the drill press, engine lathe, cutting-off machine, boring mill, etc., etc., that can be purchased from a multitude of builders, that I feel are open to many improvements. At the works of the Link-Belt Engineering Company we have about six drill presses, all running from two to three times as fast as the makers call for. It will be understood at once that as the bearings, gears, etc., are not designed for such speeds, the life of the drill press is soon reached. One manufacturer boasted that he had made his tool last for thirteen years, thinking by this argument to set aside all our criticisms of speeds and feeds, based on knowledge of yesterday. Our policy can best be expressed by quoting a statement made some five years ago by our president—*i. e.*, that "the man should be offered a premium for burning his tool." On a recent job in a drill press we found that it paid to grind up completely two drills in eight hours. The men are instructed to feed by hand when quicker than power, and oh! what wretched devices the feed mechanisms are on most of our drill presses, the motion usually being transmitted by a small belt driven by the slowest shaft on the tool.

Difficulties of the above kind will continue to exist until machine tool builders realize that machine shop practice is becoming a matter of science, not guesswork; that an intimate knowledge of the details of each tool (feeds, speeds, etc.) is absolutely essential to the foreman and to the piece-rate department of the modern shop.

After the accumulation of sufficient data of the above kind, piece rates can be set with much greater accuracy than by any other method, and in case the rate cannot be made by the workman, an investigation by the foreman shows at once the difficulty, and if justifiable, the rate is altered. At the Link-Belt Engineering Company's works, for instance, all roughing work on cast iron is supposed to be done at 55 to 60 feet per minute; 10 carbon steel at 90 feet, etc. This policy has resulted in the scrapping of many old tools and the introduction of heavier ones wherever possible.

I might also add that the attitude of the men has been most satisfactory, a keen interest being shown by them in all the work.

CHAS. DAY,
Engineer of Works.

Nicetown, Philadelphia.

Wasted Labor.

Editor American Machinist:

I don't believe that labor is altogether wasted when it is expended in finding out for certain that a thing can't be done. If it may properly be said to be wasted in such a case it at least serves to stop further waste in the same direction. But labor is certainly wasted when the only result of it is to prove that a thing simply cannot be done in certain ways or by certain means, when the ways or the means were self-evidently incompetent from the beginning. When a fellow undertakes to do a job it is his business first of all to know, without the expense of wasted labor, how not to do it.

I have often looked on at the attempted doing of things in the wrong way, and have ached and worried about mechanical operations started wrong and going from bad to worse with complete failure at the end, where I couldn't touch a thing and where it would not have been safe or "etiquettical" to say a word. All mechanics possessed of any gumption and with the habit of keeping their eyes and ears open are liable to have similar experiences.

There are two jobs that have had more or less mention in the papers, and which have not failed, as they could not have failed, to attract the interest of thinking mechanics generally, and both of these jobs as they stand at present offer striking examples of how not to do them and are mere monuments of wasted labor. Much money has been spent upon each job, more on one than on the other, as it is a bigger undertaking; also time and thought have been expended, and nothing in purposed result has been accomplished in either case.

The first of these undertakings was the ringing of the chimes of St. Patrick's Cathedral, in New York city, by mechanical means. This was a comparatively simple thing to do. There are hundreds of mechanics in America who could have made a complete success of it. There are thousands who could not be made to believe that the job could not be done; nevertheless, the scheme is abandoned and they are going to ring the chimes by hand-operated levers. A sufficient sum of money was spent upon the scheme to have made a complete success of it, and the money bought only a complete failure instead. The money was more than wasted, for it has destroyed an opportunity, for a time at least, for a mechanical success, and instead of securing for the cathedral a very desirable thing, it has barred the way to its installation.

The other job referred to, curiously enough, is also a cathedral job, the turning of the granite columns for the Cathedral of St. John the Divine, now being built in New York city. These columns, it will be remembered, were to be 54 feet long and 6 feet in diameter. Rectangular blocks of the material, of sufficient size, were cut at the quarry, and these were to be turned and polished in a lathe. It probably never struck any fellow familiar with the inside of a machine shop that there could be anything difficult about the job, except for the size and weight of the pieces to be handled. It has been generally known that a special lathe was built for these columns at an expenditure of over $50,000, and the people of course have supposed that the process of turning and finishing and transporting the columns would go on without a hitch. It must come as a surprise to all that only failure has resulted. Three successive columns have been put in the lathe; the first one was almost entirely finished, while the work upon the other two was not advanced so far, and all three have broken and are absolutely worthless, so far as satisfying this contract is con-

cerned. They are talking now of giving up the job, if they have not already done so, and are preparing to make each column in two sections, which can be done in safety.

Now it is a reproach to the mechanics of America that this job should be given up in this way. It seems to me that the only trouble is that the right fellow has not had the job, or at least that he has failed to think of some important points concerning it. It is easy enough to be wise after the event, but in this case there is something self-evident. I have understood that from the first there was great trouble about lubricating the bearings of the lathe, on account of the enormous weight to be carried. Why so carry it? Why go to the expense of a lathe strong enough to carry the total weight when the weight should have been carried by suitably contrived supports applied to the middle or between the ends of the piece. A piece of steel of this weight, if there ever should be such a piece to be turned, you can bet would never have to be all carried by the lathe, although there would of course be no danger of the steel breaking in two. There was such danger of the stone columns breaking in two that they actually did it. Of course, they ought not to have had the chance. From the beginning of operations, not waiting even for the preliminary truing of one or two circular spots on the column, yielding slings could have been provided at, say, two places on the length of it, to carry the most of the weight. These could have been connected to the pistons of compressed air cylinders in which the pressure could have been adjusted very accurately to the load. After a portion of the column was turned round shoes could of course have been blocked in below for it to run in. The published photographs of the lathe with a column in position carry no suggestion of any support for the column except the chuck on each end of it. As far as can be seen it appears that the columns break down by their own weight, and I suppose they knew their own business. It might have been at least suggested by somebody beforehand that they would be pretty sure to do this, and if the suggestion was unheeded then we have another pretty evident instance of wasted labor according to my limitation of it in the beginning. It really is not creditable to us as American mechanics that we cannot ring the bells of St. Patrick's and that we cannot turn for the cathedral of St. John the Divine the columns which the architect calls for. Why doesn't some enterprising mechanic hunt up one or both of these jobs and make a proposition of the "no cure no pay" style. There's money in it.

TECUMSEH SWIFT.

Cost of Fine Brass Castings.

Editor American Machinist:

As it has been suggested that my letter on the cost of fine ornamental brass castings, page 929, was not complete enough in the details of the work, I will try to describe the system followed in the management of this foundry. At the time that we turned out the particular lot of work mentioned in the previous article we employed a foreman, who did the green-sand and snap-flask work, one dry-sand molder, one patternmaker, whose work it was to gate the various jobs for the snap-flask work, one furnace man, who made cores and attended to the melting of the turnings, scraps, etc., and two boys, who attended the furnaces, arranging sand, did rapping, etc. We pay particular attention to what we deem the main factor in producing successfully cheap castings in this line, and that is untiring attention to the selection or sorting out of the work about to be done, so that the common smeltings will be used for such articles as will not be put to too severe a test in finish or strain, and that the higher class of metal will not be used in the making of such articles as could be made of the cheaper stock. In other words, heavy bodies, chains, etc., many of which are not seen and therefore whose finish possibilities are of no importance, ought to be made of the sweep smeltings; which smeltings, by the way, I have frequently found preferable to some of the so-called yellow-metal sold by some of the smelters, as good material to be used in fine castings. A watchful eye that all this is carried out is necessary.

Now, as regards snap-flask work for this line of goods, I know there are many who will say: "Why, we have tried snap-flask work; it is no good for work that must have a first-class face, unless you can file down or buff down the surface considerably without injury to the ornamentation, and even then the work is not satisfactory. Well, as regards that—admitting that as a rule the work is not as good as dry-sand work, as far as fine surface results are concerned—there nevertheless is a large percentage of the work that can be made with face little inferior, as it must be tooled considerably after coming from the foundry, whether made snap or dry. Here again comes into play careful selection. That snap work is more cheaply produced than dry is of course conceded, therefore we take care not to make work in dry sand that will turn out satisfactory in snap.

For our snap work we use Windsor Locks sand only. We have tried others, but have found none so good as this, and to the credit of this style of molding will say that we have turned out pieces in snap the equal of dry-sand work in every particular; and, as molders know, there are some things that go better green than dry. Of course, I do not mean that there are any ornamental pieces that cannot be made in dry sand, but it is not every dry-sand molder who is an expert, and frequently it is found easier for the ordinary molder to resort to the green method than to try it dry again. All our work that must show a fine face is of course made in dry sand, and all pattern work is made in dry sand. Our cores for slender arms are made with open, porous sand; frequently without wax tapers, as we find in some of our cores little space for sand if wax tapers and wires are used. We also use plaster core boxes when there are not a great many pieces of a kind to make and when it is possible to get along without special driers for the cores.

I believe that the low figure obtained is only on account of the careful selection or sorting out of the work, so that as much as possible is made by the snap molder without, of course, injury to the finer class of work. I might add that since the last figures given we have turned out a month's work of 6,000 pounds at an even lower cost than the cost per pound shown by me in my former article.

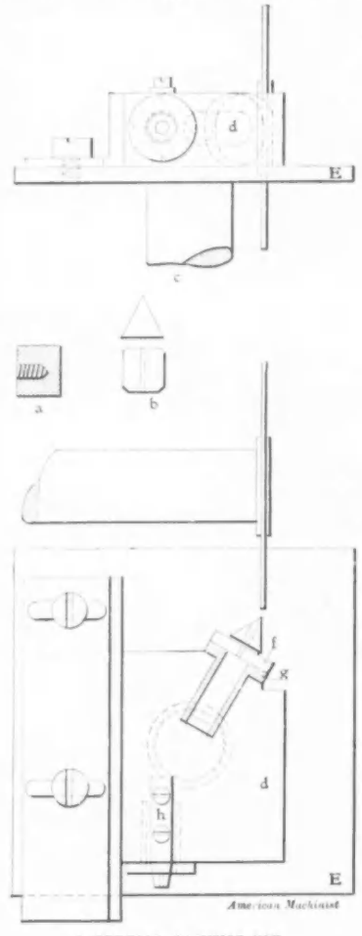
JOHN G. NIEDERER.

East Rutherford, N. J.

A Small Special Sawing Rig.

Editor American Machinist:

At *a* is a piece of round, hard rubber rod, cut off and tapped as shown; *b* is a



A SPECIAL SAWING RIG.

plan and *c* an elevation of the finished article. The sketch shows the method of shaping the piece, which was by means

of an ordinary slitting saw running on an arbor in the lathe. *E* is a table of ¼-inch sheet brass to use fastened in the tee rest and finished with the adjustable angle piece shown; *d* is a piece of hard fiber squared up and drilled with bushes let in, as shown; *f* a steel plug fitting both bushes smoothly, with four notches on the periphery of the flange to engage with corresponding projections on the flat springs *h* over the bushes. In use the piece of rod cut off is screwed on to the plug inserted in the bush, the angle piece sawn, then placed in the rearward bush, the piece *d* reversed and the parallel portion sawn, or vice versa. While somewhat of a makeshift device, there being no provision for accurate setting, still with very little of guess and try the thing can be set with a very small margin of inaccuracy.

J. Cook.

Liverpool, England.

Making Erasures on Tracings.

Editor American Machinist:

I would like to know if any of your draftsmen readers have ever tried erasing tracings by machinery. In the drawing room where I am employed we have a great deal of erasing on our tracings, it being nothing unusual for a man to work three days on one tracing erasing parts that are to be changed. Of course it is very slow and laborious work, so I suggested to our head draftsman that he get a dental engine for the purpose, having the end of the flexible shaft made to take a Faber circular eraser. He replied that for some time he had been thinking of getting a flexible shaft attached to one of the desk fans for the purpose, but as he had never seen anything of the kind he hesitated about taking the step. I would like to know if anyone has tried such a method of erasing, and, if so, what results they got from it.

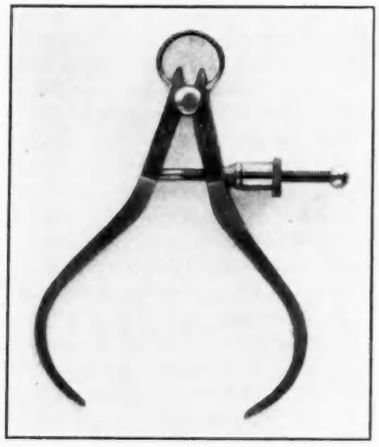
One of the drawing-room "wrinkles" that I did not see mentioned in your recent series of letters on such matters was the method we use for keeping our copies of standards handy. We make a tracing of them and paste the blueprints on the back of the T-square. Such prints, if given a coat of shellac, will keep clean and give no bother on the back of a T-square, and any draftsman can see the convenience of having such things as decimal equivalents of feet and inches, sizes of bolt heads, and so forth, right under his eyes.

Perseverance.

Some New Things.

NEW SPRING CALIPERS.

It would seem to be not an easy thing to improve upon a tool that has been so long and so universally used by inventive mechanics as have spring calipers. Yet the best spring caplier of to-day is a much better tool than the best that were in use but a few years ago, and the latest improvement upon it has been made by the Brown & Sharpe Manufacturing Company, of Providence, R. I., who have brought out a full line of calipers, dividers, etc., of which the accompanying cut



NEW SPRING CALIPERS.

is an illustration of the 3-inch size. The nut has a "rapid traverse" device, the real nut being not what is seen with the knurled collar but a split collet inside of it, which, when the pressure upon it is released, opens and slides freely over the screw, automatically closing again when pressure is applied by the spring. These parts are made of hardened steel, and the caliper is beautifully finished. The cut shows its "lines."

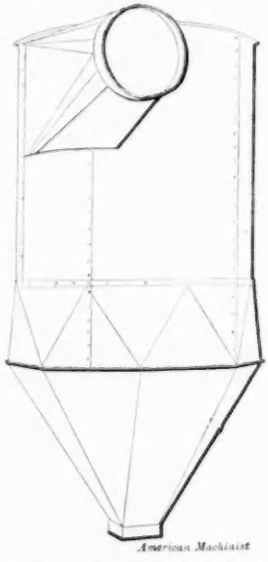


FIG. 1. A SHAVINGS AND DUST SEPARATOR.

Fig. 1 shows a new and improved separator for removing shavings, sawdust and refuse material from air currents where employed in conveyor systems in woodworking and other establishments. Fig. 2 indicates the construction. The operation of the separator depends upon the centrifugal force of the refuse material. These particles entering with the air by the large tangential passage up at the side, are discharged with a whirling motion, and, being heavier than the air, are thrown by their centrifugal force against the outer shell and pass by a helical movement down to the discharge orifice at the bottom. The air changes its direction abruptly and passes at slow speed out of the large central orifice at the top, and on account of its lessened velocity it is no longer able to carry its previous load, and the separation is thus effectively accomplished. The separator may be placed to discharge into a bin adjacent to the boiler room, or wherever most convenient. It is

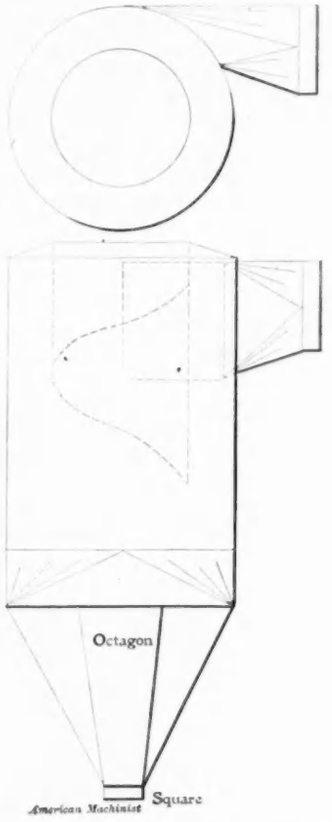


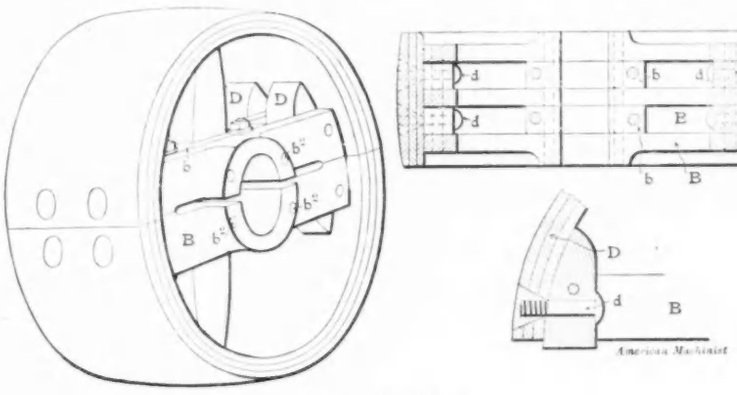
FIG. 2. A SHAVINGS AND DUST SEPARATOR.

made in several sizes by the Buffalo Forge Company, Buffalo, N. Y., is substantially made of steel plate well riveted and is stiff enough to resist all strains that may be expected.

A WOOD PULLEY.

The cut shows a wood pulley of somewhat novel construction. As will be seen, it is made in halves, as such pulleys usually are. The rim is of straight, flat stuff and is bent to the semi-circle, but instead of being made of a single thickness of wood it consists of three separate pieces. The thinness of these different layers of the rim permits them to be bent more easily and correctly, and leaves them with much less tendency to straighten out or to spring out of shape in any way. The outer and the inner layers are of hard wood and the middle layer is of soft wood. A better glue joint can thus be made than if all were of hard wood, and the softer material is assumed to act as a cushion

for the jars or blows that the face may be subjected to. The hub is formed by the arms *B* and the hub blocks *b*, secured together by glue and by the dowel pins b^2. The arm lugs *D*, secured to the arms *B* in the same manner as the hub blocks, project slightly from between the arms to interlock with the opposite section when the pulley is put together. The anchor bolts *d* pass through the arm lugs *D* and the pulley rim, with cone-shaped nuts



A WOOD PULLEY.

of soft metal which are poured or cast in the conical cavities of the rim when the parts are assembled. The soft nuts may if necessary be tightened by hammering after the metal has cooled. This pulley is clamped to the shaft by bolts in the usual way. These pulleys are made by the West Virginia Pulley Company, Clarksburg, W. Va.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(23) N. E. K., Montreal, says: A manufacturing company require $100,000 to cover manufacturing expenses for one year. To provide this amount they will have 50,000 productive hours, representing a pay roll of $100,000. Desiring to pro rate their expenses on the labor expended in manufacturing, shall they add a flat rate to their costs of 20 cents per productive hour, or shall they add to their costs 100 per cent. on the labor? On the face of it, it would appear as though an article requiring 200 hours' productive labor at 20 cents per hour should provide for a larger share of manufacturing expense than another article requiring only 100 hours at 40 cents. If the expenses are prorated on a percentage basis these two costs would, however, each stand an advance of $40 to cover manufacturing expense. If, on the other hand, a flat rate of 20 cents per hour be adopted, it seems unfair that the product of a high-priced workman, using an expensive machine, should stand only the same advance per day as the product of a $3-a-week boy, using only a vise. A.—The comparative shortcomings of the percentage and hourly burden plans were discussed at length in our issue No. 26. As was stated there both plans can be shown to lead to absurd results in extreme cases. Both are at fault in failing to distinguish between expensive and inexpensive tools. While this defect is common to both, the percentage plan has the further defect that it ignores the time element entirely. Under the conditions of most machine shops, we consider that the hourly plan is the less defective of the two. The plan used by William Sellers & Co., and described in the article referred to above, is superior to either. It is not perfect—as, indeed, no plan can be—but it overcomes these glaring shortcomings. It involves more bookkeeping than the other plans, but it should be justified by its results whenever the equipment includes tools of a cost sufficiently high to make the recognition of the difference in the cost of the various tools important.

(24) L. L., Chattanooga, Tenn., asks: Is it customary for manufacturers when purchasing equipment for plant—supposing the machinery to have been purchased in a distant city—to charge the machine to the machinery account at the invoice price, plus freight and drayage thereon and cost of erecting in the plant, or is the machinery account debited only for the purchase price of the machine, say, f. o. b. at the city where purchased and the transportation and erection charges transferred at once to the expense account? This inquiry is for the usual practice now in vogue where the purchases of machinery are for the use of the plant and not bought with a view to selling again. A.—We do not think there is any fixed practice. Each individual follows his own ideas and his practice is largely an indication of his degree of conservatism in such matters. The paying of the freight charge by the purchaser is really only an incident. Had the machinery been purchased of a local dealer, though made at a distance, the freight would necessarily be included in the invoice price and would go from there to the machinery account without question. Should the machinery be re-sold, its new purchaser, if in the same town, would be willing to pay enough for it in its new location to cover the cost of its transportation from the maker, and this regardless of who paid the freight charges. On the other hand, he would not be willing to pay the cost of drayage to or erection at a site where he could not use it. This is really the crux of the matter. In most cases if works are located in a good market for the equipment in case of sale, we should consider it proper to include the freight charges, but not the drayage charges or cost of erection in the charge to the machinery account. On the contrary, if the works were not located in a market where its equipment could be sold in case of necessity, it might be advisable to charge the freight as well as drayage and erection charges to expense. The nature of the works under consideration is, however, an important factor which would in some cases control the decision. Thus in the case of a blast furnace, for example, which would hardly be sold except as a whole and to be operated at the same site by the purchaser, it would, we think, be proper to consider the cost of erecting the blowing engine as a part of the value to be carried on the books.

New Books.

"Motor—Itis." New York Publishing Company. Sixteen 5x7 pages; paper. 10 cents.

This is the life story of an electric motor used in street-car service. It is written by Miss Carmelita Beckwith, whose position with one of the great electric companies has made her familiar with electric terms and motor anatomy, and the story of the motor gives a good opportunity for making use of the terms borrowed from human anatomy which are always applied to mechanical structures. This particular motor is supposed to be endowed with intelligence and tells its story in an interesting way. It also tells some of the stories overheard from time to time, as, for example, "a funny old man sat on the front platform one day talking with the motor-man. He said his son worked for Mr. Edison and that he understood the company were making some boosters; . . . he hoped they'd put one at his corner, as he certainly needed help in getting on and off the cars, they were so high from the ground."

Technical Publications.

"Mechanical Drawing." By F. W. Bartlett, Lieutenant Commander United States Navy. 188 6x9-inch pages, with numerous illustrations. John Wiley & Sons, New York. Price, $3.

This book has been "written for the use of the naval cadets at the United States Naval Academy" and aims to give the methods of the Bureau of Steam Engineering, with some reference to those of the Bureau of Ordnance and of the

Bureau of Construction. So far as we can judge, it is well adapted to its intended purpose, though it can scarcely be recommended as a guide to the general student. It is generally understood that the departments of the government are pervaded by a spirit of needless and pedantic precision which is unknown in commercial life, and the author of a text book for students in a government school is perforce compelled to recognize and teach the methods used in the departments. This, no doubt, explains the presence of many things in the book which, were it intended for the general student, we should feel like criticising, but which, under the circumstances, could not, probably, be changed.

One feature of the methods of the Academy deserves favorable notice. It appears that it has in stock certain models of engine parts which are placed before the student and from which, by direct measurement, he makes his first working drawings. So much of the present book as relates to working drawings refers directly to these models, hints and suggestions regarding the drawings being given, but no engravings to serve as copies.

A Book Notice.

Our esteemed and most respected contemporary, "The Locomotive," is working a scheme to get an up-to-date library. All the enterprising publishers will be sending in their books for notice. Here is how one publication was served up recently:

"We have received, from the publishers, a copy of 'An Englishwoman's Love Letters,' with a request that we give it a review in 'The Locomotive.' We have no regular love letter editor on our staff, and we therefore turned it over, first, to our expert on riveted joints, who is reputed to have had some experience in such matters. He says that the writer of the letters is badly designed; that she has a poor circulation and a cracked head, and that a few bricks are loose in her setting; and he swears he will take no responsibility for her, until she has been submitted to a hydrostatic test of at least a thousand pounds. His judgment has always been good on matters more directly in his line, but we were so sure that it was in error in this particular case that we took the book away from him and made a complete internal inspection of it ourselves. We quickly found that the language is so warm that our expert on combustion was the proper man to consult. He was on his vacation, however, and we didn't want to call him back to make a calorimeter test during this hot weather. Our chemist shook his head sadly when we offered the job to him, and the only available man left on our staff was the automobile editor, who takes the place of the horse editor that we discharged when the horse went out of fashion. He says the author has wheels all right. He doesn't wish to condemn the book though, for he says that while it isn't in *his* line, he should judge that it would be hot stuff in somebody else's line. With this sentiment we heartily agree. It is our custom, in reading a work of fiction, to pick out the one passage in the whole book that seems to be most pat. We think we have found it, in this book, on page 203, where the author of the letters says to her hubby, 'Oh, how tired loving you now makes me!' To which we would fervently respond, 'Amen!' (Laird & Lee, Chicago.)"

Our Neighbor's Loss.

The London "Economist' displays considerable interest in the Canadian census, regarding it, as becomes a paper so named, chiefly for the lesson it teaches in respect of the relations between Canada and the United States. The "Economist" agrees with the rest of us in charging a goodly share of the loss of population to the contiguity of the States. As "Economist" points out, everything we do to make living in Canada more agreeable seems to contribute to our loss. If we build railways, the railways make it so much easier for our people to emigrate. If we establish a manufacturing industry at great sacrifice, the industry trains hundreds or thousands of young men to a point where they can command high wages in the States. If we bring our common school system up to the point of perfection, what we accomplish is to provide the youth of the land with tastes they can best gratify in American cities. Population increases as we would wish it to only in those parts where people go upon the land and deliberately cut themselves off from such advantages.—Montreal "Herald."

Legal Notes.

LAW POINTS FOR THE MACHINE SHOP COMPILED FROM LATE DECISIONS IN VARIOUS STATES.

Employers are not insurers of the safety of appliances furnished by them, as they are bound to exercise only reasonable care to supply safe appliances. (57 N. E. Rep. 1104.)

In case of an accident to an employee, even where the conditions are so obviously dangerous as to give rise to an inference of negligence, the employer has not the burden of satisfactorily accounting for the accident, but merely of showing due care. (47 Atl. Rep. 875.)

Except in cases of railroad companies, the employer is not liable to one servant for injuries arising from the negligence of another servant about the same business. (37 S. E. Rep. 360 Ga.)

An employer is not excused from liability for injury to an employee, from want of a safe place in which to work, because the lack of safety was due to the omission of a fellow employee. (57 N. E. Rep. 1107.)

An employer is liable for an injury to a workman of which the negligence of a vice-principal was a proximate contributing cause, although the negligence of a fellow workman was also contributory. (104 Fed. Rep. 737.)

The failure of a company's foreman to secure a pump, so as to prevent injury to a minor apprentice who was wrongfully directed to work the pump, was the failure of the company, for which it was responsible. (57 N. E. Rep. 1125.)

Where an employee complained of an appliance as unsafe and was told he might either continue to use it or leave, and he continued afterwards to use it, rather than lose his place, he will be held to have assumed the risk and cannot recover for resulting injuries. (58 N. E. Rep. 585.)

Where danger, if any, is apparent and good and sufficient material is supplied, which employees are authorized to use as they deem necessary, the employee assumes the risk, and there is no negligence on the part of employer. (84 N. W. Rep. 253.)

Minor servants are held to assume, by their contract of employment, those ordinary risks of their service that are obvious to them, or that have been pointed out to them in a manner suited to their youth and inexperience. (47 Atl. Rep. 504.)

Negligence of an employer is not shown by the mere fact that the method of doing work was unusual. It must be more dangerous in itself than the ordinary one. (47 Atl. Rep. 846.)

An injury received by a workman in attempting to procure a tool necessary in his work is in the line of his employment, which will warrant a recovery against the employer for an injury resulting from the negligence of the latter. (14 Pa. Super. Ct. Rep. 626.)

The employer is liable to a third person for an injury growing out of the employee's negligence, but if he has not been guilty of contributing to the injury he may recover back from the employee any damages he has been compelled to pay for such injury. (26 So. Rep. 992.)

The American-Made Renold Transmission Chains.

The Link Belt Engineering Company, of Nicetown, Philadelphia, and its affiliated company, the Link Belt Machinery Company, of Chicago, have taken up the manufacture in this country of the transmission chains of Hans Renold, of Manchester. A long time has been spent in study of Mr. Renold's methods of manufacture and in thorough preparation for manufacture here, with the result that Mr. Renold has expressed himself as being entirely satisfied with samples of his chains made here—a certificate of character which to those who know Mr. Renold will mean much. The experimenting has been all

done in this case, and it is believed that the American-made Renold Silent Transmission Chain (which we illustrated and described at page 361, volume for 1898) will become as popular here and will fill as important a sphere in mechanical engineering work as it now does in Britain and on the Continent.

One of our readers wrote to suggest a complete index to the "American Machinist" and expressed the belief that enough readers would pay well for such an index. We were inclined to think that there were not enough so disposed to pay the expenses of getting it done, and our correspondent suggests that we try and find out. How many readers would give $20 for a complete index of the "American Machinist" for twenty-five years and how many would give $10 for an index for ten years?

The Thos. S. Clarkson School of Technology, Potsdam, N. Y., has been thoroughly provided for in the appointment of new instructors, additional equipment and reorganization of courses. There are regular four-year courses in theoretical and practical work leading to degrees of Bachelor of Science in Civil, Electrical and Mechanical Engineering. The entrance requirements are those of the Regents of the University of the State of New York.

New Catalogs.

The Chicago Pneumatic Tool Company has issued rather an elaborate pamphlet, chiefly pictorial, relating to its hammers, drills, riveters, etc., which is 9⅜x11⅞ inches in size.

The Warner & Swasey Company, Cleveland, O., is publishing a handsome catalog of its 30-inch vertical turret machine for boring and turning. Size of page, standard, 6x9 inches.

The Cleveland Machine Screw Company, Cleveland, O., publishes a pamphlet describing its Pan-American exhibit, which was presented in our issue No. 37. Size, standard, 6x9 inches.

We have received a pamphlet of the Westinghouse Air-Brake Company, Pittsburgh, Pa., describing its combined magnetic braking and car-heating apparatus (Newell patents). Size, 9x6 inches, standard.

We have received a little pamphlet describing the friction sensitive drill press having variable feed, without cone pulleys or shifting of belts, manufactured by the Knecht Bros. Company, Cincinnati, O.

The Thomson Electric Welding Company, Lynn, Mass., has published a pamphlet describing the electric welding process and the apparatus of which this company is manufacturer and lessor. Size, 7x8¼ inches.

The Standard Tool Company, Cleveland, O., has published a little pamphlet relating to "Taladros salomonicos, alegradores," and other tools, in which their line of twist drills, reamers, etc., is briefly introduced to Spanish buyers. Size, 3½x6 inches, standard.

J. T. Slocomb & Co., Providence, R. I., have brought out a new catalog giving views, descriptions and prices of their varied line of micrometer calipers and gages adapted especially to machine shop purposes, combination center drills, etc. Standard size, 6x9 inches.

"The Bending Book" is gotten up by Estep & Dolan, Sandwich, Ill. It summarily presents the eye benders and angle benders for hand and foot power which they manufacture and shows the sort of work the machines turn out. Size of page, 3½x6½ inches.

The Jeffrey Manufacturing Company, Columbus, O., has sent us a copiously illustrated pamphlet (9x6 inches, standard size) on electric locomotives; also one (3½x6 inches, small standard size) giving a general idea of the manufactures of the company—conveying machinery, etc.

Record of Recent Construction, No. 27, of the Baldwin Locomotive Works, Philadelphia, comprises a paper on "Broad Firebox Locomotives," read by Samuel M. Vauclain before the Pennsylvania Railroad Young Men's Christian Association, March 25, 1901. It is of standard size, 9x6 inches.

The Adams Company, Dubuque, Ia., has brought out a catalog, No. 6, relating to the Farwell automatic molding machine, which is here described and is illustrated in different stages of the molding process. "Something About Patterns" is a feature of the pamphlet, which is 6x9¼ inches in size.

We have received a copy of a booklet which the Westinghouse Companies, Pittsburgh, Pa., have prepared for distribution at the Pan-American Exposition. It gives a comprehensive idea of the Westinghouse industrial enterprises and some of the notable work accomplished by them. Size, 4x8½ inches.

The Lane & Bodley Company, Cincinnati, O., has sent us a copy of the fiftieth anniversary edition of its catalog, showing its new twentieth century engine, which we have already mentioned. Several types of engines built by the company are here set forth with detailed description and tabulated data. The catalog is 9x6 inches, standard size.

The Roller Bearing & Equipment Company, Keene, N. H., has published a 1901 catalog of ball and roller bearings for all kinds of machine construction. Bearings for motor vehicles and railway cars may be noted in particular. On page 1 are some brief practical suggestions on general topics to patternmakers, machinists, etc. Size, 4¾x7 inches.

"The Triumph of Evolution: A Story of the Briquetting Press, by B. C. White," is the title of a pamphlet published by the Henry S. Mould Company, Pittsburgh, Pa. It contains, with some descriptive matter, a series of views showing the development of the White briquetting press, mineral press and eggette machine. Page size, standard, 9x6 inches.

We have received a catalog of drop forgings published by J. H. Williams & Co., Brooklyn, N. Y. It shows a great variety of wrenches, as well as lathe dogs, hoist hooks, crank shafts, automobile parts, valve stem forgings, key forgings, tool-post fittings, machine handles, etc. The book is embellished with some artistic views of the company's works. Size, 4½x7 inches.

The Hilles & Jones Company, Wilmington, Del., has published a new catalog of machine tools for working plates, bars and structural shapes. It contains twenty illustrations of new machines, modifications of standard designs and special attachments for punches and shears not shown in previous catalogs. The pamphlet is chiefly pictorial and is printed on glazed paper. Size, 9x9 inches.

The Brown Hoisting Machinery Company, Cleveland, O., has published an enlarged edition of its pamphlet relating to overhead tram rail and trolley apparatus. They say there seems to be a growing demand for these appliances of a high-class construction. The pamphlet supersedes former lists in this connection, and is of standard size, 6x9 inches.

The Goodman Manufacturing Company, Halstead street and Forty-eighth Place, Chicago, has published a new catalog of its electric chain breast machine for mining, with an illustrated list of parts, which are identified by name, number and code word, and with a complete list of the general electrical supplies that are required to install electric mining machinery of this character. Size, 6½x9 inches.

We have received several catalogs of the Richards Machine Tool Company, 5 Laurence Poultney Hill, London, E. C. One is an illustrated price list and index to the company's sectional catalogs; another is "Section D," relating to Anglo-American lathes, the parts of which are severally described, and another is an edition in French of the index and price list first mentioned. These pamphlets are 6x9 inches, standard size.

The Empire Engine & Motor Company, Orangeburgh, N. Y., has published a new catalog, No. 2, which illustrates and describes its air tools, including pneumatic motor chain hoists, drills and reamers, center grinders, crane motors, portable winches, hoisting engines, etc. A number of line drawings help to explain the mechanism of some of these machines. The pamphlet is 6x9 inches, standard size.

"The Uses of Expanded Metal" is the title of a pamphlet published by the St. Louis Expanded Metal Company, St. Louis, Mo. The uses indicated are those of a strengthening fabric to be embedded in different concrete constructions. The pamphlet contains a discussion of the strength of steel-concrete beams, abstracted from a paper before the American Society of Civil Engineers by A. L. Johnson. Size of page, 6x9¼ inches.

We have received three catalogs of the Kilbourne & Jacobs Manufacturing Company, Columbus, O. No. 7 (4x6¼ inches) shows trucks of all kinds, baggage barrows, express wagons, etc. No. 31 (6x9 inches, standard size) relates to small cars of all kinds, such as contractors' dump cars, steel, ore and mine cars and skips, factory, foundry, billet, coal and coke cars. No. 33 (6x9¼ inches) is concerned with wheel and drag scrapers, wheelbarrows, contractors' plows and carts, steel tote boxes, steel barrels, steel shop pans, steel sinks, etc.

Exceptionally fine is a set of publications brought out this season by the Bullard Machine Tool Company, Bridgeport, Conn. One of them is "A Treatise on Boring and Turning Mills," which, in addition to descriptive matter for the enlightenment of the prospective buyer, contains more than a score of large, clear illustrations of the mills performing various operations. Another pamphlet is a catalog of boring mills, presenting an extensive line. A third is a catalog of turret machines and lathes. All these pamphlets are gotten up apparently with a view to making the artistic presentation of the machines consistent with their technical merits. Each is of standard size, 6x9 inches.

Several small pamphlets have lately come from the Buffalo Forge Company, Buffalo, N. Y. One is a little catalog of a line of disk wheels of the pulley, steam and electric types, which besides illustrating and describing them shows a number of their applications. A second pamphlet shows the forms and uses of Buffalo "B" volume blowers. A third relates to steel plate planing mill exhausters, which are special types of centrifugal fans and are applied for exhausting

shavings, sawdust, emery-wheel refuse, etc. Each pamphlet is 6½x3½ inches.

We have already made mention of the scope and plans of the South Carolina Interstate and West Indian Exposition, which is to open December 1 in Charleston. A pamphlet has since been received from the manager of the Department of Promotion and Publicity, entitled "Charleston and Its Exposition." This was prepared by Col. Alexander D. Anderson, of Washington, D. C., and is intended to set forth some of the advantages of the port of Charleston and some of the objects to be accomplished by the Exposition. It gives a sketch of the industries tributary to Charleston. Size of page, 6x9 inches, standard size.

The Northern Electrical Manufacturing Company, Madison, Wis., has published a pamphlet which, for an electrical catalog, will be more than usually interesting to machine tool men. It relates to shop and tool equipments with Northern motors, a subject which is treated with copious text and plentiful illustration. There are included a reprinted article by Louis Bell, on the applications of electric power in engineering works; one by William S. Aldrich on electrical transmission in factories and mills, one by W. H. Tapley on electricity in printing, and also some excerpts from the American Railway Master Mechanics' committee report on electric drive. The pamphlet is 7x10 inches.

Manufacturers.

The Lebanon Mill Company, knitted fabrics, Pawtucket, R. I., will build a new mill.

The Lehigh Foundry Company's foundry at Fullerton, Pa., has been destroyed by fire.

The factory at Astoria, Oregon, of the American Can Company is to be enlarged.

The Indiana Pulp & Paper Company has decided to rebuild its factory in Marion, Ind.

The Onalasken Woolen Manufacturing Company, Onalasken, Wis., will enlarge its plant.

A new foundry building is to be built by the Northwest Thresher Company, Stillwater, Minn.

An attempt is being made to organize a company to manufacture steel cars at Canton, O.

E. A. Stege, Louisville, Ky., will erect a building for use as a brass foundry and plating works.

The plant of the Bolivar Foundry & Machine Company, Bolivar, Pa., has been damaged by fire.

The Exeter Machine Works, Pittston, Pa., has increased its capital stock from $50,000 to $300,000.

The burned factory of the Cadillac Handle Company, Cadillac, Mich., will be rebuilt on a larger scale.

Improvements have been commenced on the Greenville, Pa., plant of the Shelby Steel Tube Company.

A factory is to be erected for the Kirk-Latty Manufacturing Company, tacks, bolts, etc., Cleveland, O.

Gray & Blaisdell, Bradford, Pa., manufacturers of air and gas compressors, are building a new factory.

The Loy-Lange Box & Lumber Company, St. Louis, Mo., has taken steps to erect a new modern box factory.

Buildings are being put up for the Altoona Foundry & Machine Works, recently formed at Altoona, Pa.

The M. Campbell Fanning Mill Co., Ltd., of Chatham, Ont., proposes to enlarge its plant at Detroit, Mich.

The Chicago Writing Machine Company,

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 22.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks., Waltham, Mass.

Gas engines. Northern Engin'r'g Works, Detroit.

Map or mechanical draftsman. H. A. Horsfall, 136 Liberty st., New York.

Wanted—Improvements in grinding machinery. Address Box 1435, Providence, R. I.

Experimental work, light machinery made. S. Messerer, 24 Boudinot st., Newark, N. J.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas, Bridgeport, Ct. Send for index sheet.

Elec. & mech. designing & drawing, also ideas developed. Box 709, Schenectady, N. Y.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

See 12 presses & dies for sheet-metals, S. E. cor. Machinery Hall, Buffalo Exposition. Ferracute Mch. Co., Bridgeton, N. J.

Wanted—A 100-pound power spring hammer of any good make. Send description and price to Thomas B. Jeffery & Co., Kenosha, Wis.

Machinery built by contract; modern equipment and organization; accurate work; prompt delivery; low prices; weights up to 5 tons. The Blanchard Machine Co., Boston.

For Sale at Low Price—Two Warner & Swasey's four-spindle valve milling machines in good condition; W. & S. 1901 catalog, page 54. The Kelly & Jones Co., Greensburg, Pa.

Gear and Milling cutters, adjustable reamers and special tools; vertical millers, cutter and surface grinder and shears. Catalog of small tools free. R. M. Clough, Tolland, Conn.

Parties having tools for the manufacture of "Jenkins" brass globe and angle valves and wishing to dispose of same, could possibly do so to advantage by addressing Box 48, A. M.

Know a certain line of manufacturing thoroughly; want party to assist me financially to start either independently or in connection with your present business; correspondence solicited. Box 28, AMER. MACH.

Purchaser for small manufacturing plant; lot, 100x180 feet; machine shop, 32x68, two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Co., Madison, Wis.

Will trade patents and business of a strictly modern electric railway truck for interest in works where same can be manufactured; would superintend manufacturing if desired. Address "Railway Truck," 139 Holley Court, Oak Park, Ill.

A prominent typewriter manufacturing company have just opened a department for the manufacture and sale of novelties. Responsible parties having something of this class to turn out will oblige by addressing "Work," care AMERICAN MACHINIST.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

For Sale or Trade—Machine shop, 40x40; 500 ft. glass light; first-class location here; 1 Putman lathe, 20 in.; 1 Lodge & Davis drill press, 32 in.; 1 New Haven drill, 16 in.; 1 6 in. iron shear, 1 emery wheel and stand, 1 steam engine, 6 H. P.; upright boiler, Fritze make; 41 ft. 2 3-16 shafting, complete with hangers, and lot of small tools. Don't write unless you are in for business. Martin Hamm, Strasburg, Shelby Co., Ill.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

Mechanical draftsman wishes to change. G. F., Box 61, AMERICAN MACHINIST.

Practical mechanical draftsman wishes position. Box 34, AMERICAN MACHINIST.

Competent machine shop foreman, varied experience, desires change. Box 52, AM. M.

Draftsman wants position as designer of special machinery. Box 62, AMER. MACH.

Position as designer of printing presses, by experienced man. Box 63 AMER. MACHINIST.

Draftsman wants position; experienced on automobile work; now employed. Box 60, AMERICAN MACHINIST.

By young man, in drafting room; had experience; not particular about locality. 43 Jackson st., Palmyra, N. Y.

Mechanical engineer, 17 years' experience, desires change; specialty of cost reduction. Box 59, AMERICAN MACHINIST.

Machine shop foreman with first-class references desires position; correspondence solicited. Box 37, AMERICAN MACHINIST.

Evening employment, at home or otherwise, in New York, by Cornell electrical and mechanical engineer. Box 51, AMER. MACH.

Technical graduate, 18 years' experience, desires position as chief draftsman or mechanical engineer. Box 58, AMER. MACH.

Position as manager or superintendent of gas or steam engine shop; now holds first-class position; age 35. Box 5, AMER. MACH.

Assistant superintendent's position wanted by American of 34; thoroughly familiar with shop practice, cost and estimate. Address "Progress," Box 29, AMER. MACHINIST.

A young mechanical engineer, with business experience, desires a position; is at present employed, but wants to get into more practical work. Box 36, AMERICAN MACHINIST.

Designer of machine tools and jigs, now holding responsible position, desires, for private reasons, to change; has first-class record; salary $1,500. Box 54, AMER. MACH.

Draftsman as designer of printing presses or special machinery, where originality of ideas and ability will be appreciated; Western States preferred. Box 64, AMER. MACH.

Wanted—A position as draftsman, by young man of 5 years' experience drafting and 6 years' shop work, largely experimental; near Boston preferred. Box 45, AM. MACH.

A mechanical engineer seeks engagement with manufacturing concern who requires experienced services and is willing to appreciate devotion to duties; only responsible work is sought. Box 31, AMERICAN MACHINIST.

Machinist with technical education and considerable experience as foreman and designing draftsman on metal-working machinery, tools, sheet metal dies, etc., wants charge. Address Box 53, AMER. MACHINIST.

We can furnish names and records of competent men for positions as managers, superintendents and foremen in metal-working lines; no charge. Address James Brady, 220 Broadway, New York (formerly of Brady Mfg. Co.).

Competent tool department foreman; most modern shop practice; experience equipping large factories with precision tools, fixtures, special automatic machines, interchangeable work, etc.; understands premium system; A1 reference; age 29. Berger, 198 Hudson ave., Brooklyn, N. Y.

Wanted—Situation as superintendent or general foreman, by thoroughly competent young machinist; has had large experience in all branches of the trade and in charge of shops; possesses keen executive ability and will furnish good references. Address Box 50, AMERICAN MACHINIST.

Help Wanted.

Wanted—A first-class toolmaker, by The Lane & Bodley Co., Cincinnati, O.

Wanted—A first-class draftsman familiar with paper machinery. Box 41, AM. MACH.

Molders; 35c. per hour; engine and general job work; no bench men. Denver Engineering Works, Denver, Colo.

Wanted—A practical man of experience, as foreman of a machine shop in a frog and switch works. Address Y., care AM. MACH.

Wanted—A first-class draftsman; one familiar with designing gas engines; give experience and salary wanted. McEwen Bros., Wellsville, N. Y.

First-class brass molder wanted as working foreman in a small brass shop near New York; references required. Address Box 43, AMERICAN MACHINIST.

Draftsman wanted with experience on